THE JOURNAL OF
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

(Including Transactions)

Volume 36 DECEMBER 1914 Number 12

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PUBLISHED MONTHLY BY

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 West Thirty-ninth Street, New York

PRICE 35 CENTS A COPY, $3.00 A YEAR; TO MEMBERS AND AFFILIATES, 25 CENTS A COPY, $2.00 A YEAR. POSTAGE TO CANADA, 50 CENTS ADDITIONAL; TO FOREIGN COUNTRIES, $1.00 ADDITIONAL

C 55. The Society as a body is not responsible for the statements of facts or opinions advanced in papers or discussions.

Entered as second-class matter, January 4, 1912, at the Postoffice, New York, N. Y., under the act of March 3, 1879

COMING MEETINGS OF THE SOCIETY

Annual Meeting, December 1–4, *New York City.* For program see p. IV.

December 8, *San Francisco, Cal.* Paper: A Novel Method of Handling Boilers to Prevent Corrosion and Scale, by Allen H. Babcock, Consulting Electrical Engineer, Southern Pacific Company.

December 9, *Boston, Mass.* Engineers Club. Paper: The Technology of Paper Making, by V. E. Nunez, expert with Arthur D. Little, Inc., Boston.

January 8, *Chicago, Ill.* Railroad meeting, with papers on Locomotive Superheaters and Stokers.

January 14, *Philadelphia, Pa.* Joint meeting with the Franklin Institute. Paper: Modern Steels and their Heat Treatment, by Robert R. Abbott.

THE JOURNAL OF

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

(Including Transactions)

Volume 36 December 1914 Number 12

THE ANNUAL MEETING

DECEMBER 1-4, 1914

THE feature of the professional sessions of the Annual Meeting will be the sessions on Thursday, December 3, relating to the work of the Engineer in Public Service. The session in the morning will be opened by the Hon. John Purroy Mitchel, Mayor of the City of New York, and papers will be presented by Henry Bruère, City Chamberlain of New York City and director of the National Bureau of Municipal Research; Morris L. Cooke, director of the Department of Public Works of Philadelphia; Edward Flad, consulting engineer, St. Louis; and C. E. Drayer, chairman of the Publicity Committee of the Cleveland Engineering Society. At the afternoon session papers will be presented by Frederick W. Ballard, Commissioner of Lighting of the Department of Public Utilities of Cleveland; George S. Webster, chief engineer of the Bureau of Surveys of Philadelphia; Clyde Lyndon King, assistant professor in Political Science of the University of Pennsylvania; and Sanford E. Thompson, consulting engineer, Newton Highlands, Mass.

These Public Service sessions have been arranged by the Public Relations Committee of the Society and will draw to the attention of engineers the opportunities for the application of their special training and knowledge to the better solution of the many important engineering problems that confront the large municipality.

In the sessions devoted to miscellaneous engineering subjects, it will be noted by reference to the program that several of the papers have been contributed by sub-committees of the Society, which emphasizes the work which the Society is doing in presenting authoritative contributions on different phases of a variety of engineering subjects. There are to be six professional sessions on the technical side of mechanical engineering, in which the variety of papers is so great that they are bound to appeal to the membership in one way or another. One of these sessions, as at recent meetings, will be devoted to a discussion of railroad subjects. The sub-committee on Railroads has prepared a report on Steam Locomotives of Today, upon which discussion has been invited from railroad men who have specialized on different aspects of the subject.

All of the papers listed in the program are now available for distribution and copies of any of them will be mailed free to members requesting them in advance.

On Wednesday morning at the business session the progress report of the Boiler Specifications Committee will come up for discussion. This report, which has been in preparation for the past three years, is one of the most important ever issued by the Society, and has required weeks of devoted labor on the part of the committee. During the past two months there have been almost constant conferences with engineers, manufacturers and professional organizations, and the report has been studied from every angle, with a view to establishing a standard that may form the basis for uniform and safe practice in the construction and operation of steam boilers throughout the country.

On Wednesday evening, the John Fritz Medal will be awarded to Prof. John E. Sweet, Honorary Member and Past-President of the Society, "for his achievements in machine design and for his pioneer work in applying sound engineering principles to the construction and development of the high-speed steam engine." To Professor Sweet more than to any other living man the formation of the Society is due, through his personal work in visiting engineers throughout the country and interesting them in the possibilities of a national organization for the advancement of mechanical engineering. The John Fritz Medal is awarded by the four national engineering societies. Following the presentation there will be addresses by Dr. James Douglas, Honorary Member and Past-President of the American Institute of Mining Engineers, and by Dr. S. W. Stratton, Director of the Bureau of Standards, on the Development of Engineering in the United States, Dr. Stratton speaking especially of the relation of the Bureau of Standards to such development.

On Thursday evening the chief social event of the meeting will take the form of a dinner dance. Covers

will be laid in the main ballroom of the Hotel Astor and there will be dancing between courses. A large attendance is expected.

The Ladies Committee is arranging for a reception and thé dansant to be held on Wednesday afternoon in the rooms of the Society, at which both members and guests will be welcomed.

The Excursion Committee has arranged as usual for visits of interest about the city, including manufacturing plants and power stations, so that those who so desire will be able to see as much of the important engineering features in this vicinity as time will permit.

PROGRAM

Tuesday Afternoon, December 1

Registration. Council Meeting at 4.00 p.m.

Tuesday Evening

OPENING SESSION, 8.30 P.M.

President's Address, THE HUMAN ELEMENT THE KEY TO ECONOMIC PROBLEMS, James Hartness

Report of Tellers of election of officers

Introduction of President-elect

Reception by the Society to the President, President-elect, ladies, members and guests in the rooms of the Society. Music and refreshments. Open to all members and guests.

Wednesday Morning, December 2

BUSINESS MEETING, 10.00 A.M.

Reports of the Council and Standing Committees. Amendment to C 45 of the Constitution. Progress Report of the Boiler Specifications Committee

PROFESSIONAL SESSION

FLOOR SURFACES IN FIREPROOF BUILDINGS, Sanford E. Thompson

(CONTRIBUTED BY THE SUB-COMMITTEE ON INDUSTRIAL BUILDING.)

REINFORCED-CONCRETE FACTORY BUILDINGS, F. W. Dean

(CONTRIBUTED BY THE SUB-COMMITTEE ON TEXTILES.)

Wednesday Afternoon

PROFESSIONAL SESSION, 2.00 P.M.

MEASURING EFFICIENCY, H. L. Gantt

STANDARDIZATION IN THE FACTORY, C. B. Auel

(CONTRIBUTED BY THE SUB-COMMITTEE ON MACHINE SHOP PRACTICE.)

OPERATION OF GRINDING WHEELS IN MACHINE GRINDING, Geo. I. Alden

FRICTION LOSSES IN THE UNIVERSAL JOINT, P. F. Walker and W. J. Malcolmson

RAILROAD SESSION (SIMULTANEOUS), 2.00 P.M.

STEAM LOCOMOTIVES OF TODAY: Report of the Sub-Committee on Railroads

Wednesday Evening

JOHN FRITZ MEDAL AWARD, 8.30 P.M.

The John Fritz Medal will be awarded to Prof. John E. Sweet, Honorary Member and Past-President of the Society. Addresses by Dr. James Douglas, Honorary Member and Past-President of the American Institute of Mining Engineers and Dr. S. W. Stratton, Director of the Bureau of Standards.

Thursday, December 3

There will be an all-day Public Service Meeting on the subject of Engineering in the Administration of a City, with papers contributed by the Committee on Public Relations. The following is a tentative program:

PUBLIC SERVICE SESSION, 10.00 A.M.

OPENING REMARKS, Hon. John Purroy Mitchel, Mayor of the City of New York

THE FUTURE OF THE POLICE ARM FROM AN ENGINEERING STANDPOINT, Henry Bruère

SOME FACTORS IN MUNICIPAL ENGINEERING, Morris L. Cooke

THE NEW CHARTER FOR ST. LOUIS, Edward Flad

THE ENGINEER AND PUBLICITY, C. E. Drayer

SNOW REMOVAL: A Report of the Committee on Resolutions of the Snow Removal Conference held in Philadelphia, April 16 and 17, 1914

Thursday Afternoon

PUBLIC SERVICE SESSION (CONTINUED), 2.00 P.M.

THE DESIGN AND OPERATION OF THE CLEVELAND MUNICIPAL ELECTRIC LIGHT PLANT, Frederick W. Ballard

THE HANDLING OF SEWAGE SLUDGE, George S. Webster

TRAINING FOR THE MUNICIPAL SERVICE IN GERMANY, Clyde Lyndon King

A STUDY OF CLEANING FILTER SANDS WITH NO OPPORTUNITY FOR BONUS PAYMENTS, Sanford E. Thompson

PROFESSIONAL SESSION (SIMULTANEOUS), 2.00 P.M.

FACTORS IN HARDENING TOOL STEEL, John A. Mathews and Howard J. Stagg, Jr.

(CONTRIBUTED BY THE SUB-COMMITTEE ON IRON AND STEEL.)

STANDARDIZATION OF CHILLED IRON CRANE WHEELS, F. K. Vial

(CONTRIBUTED BY THE SUB-COMMITTEE ON HOISTING AND CONVEYING.)

THE MECHANICAL ELIMINATION OF SEAMS IN STEEL PRODUCTS, NOTABLY STEEL RAILS, R. W. Hunt

CEMENT SESSION (SIMULTANEOUS), 2.00 P.M.

Informal gathering of those interested in the Manufacture of Cement, with paper on ELECTRIC DRIVE FOR ECONOMIC OPERATION AND DEVELOPMENT OF CEMENT MILLS, J. Benton Porter

STUDENT BRANCH CONFERENCE, 4.00 P.M.

A conférence of the honorary chairmen of the Student Branches will be held with the Committee on Student Branches

Thursday Evening

DINNER DANCE, 7.00 P.M.

This is the main social event of the Annual Meeting and will be held in the grand ballroom of the Hotel Astor.

Friday Morning, December 4

PROFESSIONAL SESSION, 10.00 A.M.

A RATE-FLOW METER, H. C. Hayes

LABORATORY FOR TESTING AND INVESTIGATING LIQUID FLOW METERS OF LARGE CAPACITY, W. S. Giele

A NEW VOLUME REGULATOR FOR AIR COMPRESSORS, Ragnar Wikander

PHYSICAL LAWS OF METHANE GAS, P. F. Walker

THE CLINKERING OF COAL, Lionel S. Marks

DAMAGES FOR LOSS OF WATER POWER, F. W. Dean

Friday Afternoon

Council Meeting at 2.00 p.m.

COLLEGE REUNIONS

It has been the custom of certain of the technical schools to hold reunions in New York on the last day of the Annual Meeting (which this year will be December 4), to welcome the large number of out-of-town members. Complete details will be given in the program distributed at the Annual Meeting. The following reunions have been planned for that evening:

BROWN UNIVERSITY

The Engineering Alumni will hold a reunion dinner at the Brown Club, West 44th Street, at 6.30 o'clock. It is expected that Professor Wm. H. Kenerson will be toastmaster. Those desiring to attend are requested to communicate with Alfred F. Masury, Chairman, care of International Motor Company, 64th Street and West End Avenue, New York.

CORNELL UNIVERSITY

The Alumni of Cornell University are planning a reunion at the Cornell Club in which Cornell members of the Society and their guests are invited to participate. Further information may be obtained from H. O. Pond, care of Westinghouse, Church, Kerr & Co., 37 Wall Street, New York.

KENTUCKY STATE UNIVERSITY

The Kentucky State University Club of New York will hold a meeting on Friday evening, and invite all members of the Alumni to plan to be present as an enjoyable evening is anticipated. Information may be obtained from C. E. Daniel, 101 Park Avenue, New York.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

An informal dinner and "smoker" will be held at the Technology Club, 17 Gramercy Park, New York. All members of the Alumni Association of Massachusetts Institute of Technology are earnestly invited to be present. Full information can be secured by addressing G. F. Shaffer, Technology Club, New York City.

POLYTECHNIC INSTITUTE OF BROOKLYN

The Mechanical Engineering Alumni of the Polytechnic Institute of Brooklyn will hold a reunion in the rooms of the Society at 8.15 o'clock.

Edwin B. Katte, Vice-President of The American Society of Mechanical Engineers, will present an illustrated lecture on Electrification of the Grand Central Terminal. An invitation to attend is extended to all members of the Society as well as the Alumni of Polytechnic Institute.

PURDUE UNIVERSITY

The Purdue Club of New York City will hold its annual election of officers on the evening of December 4, 1914, and extend a cordial invitation to the Alumni of Purdue University to be present. This event always brings out a large attendance and affords an excellent opportunity for a reunion. E. W. Davis, Room 2101, 165 Broadway, New York, will furnish further details.

STEVENS INSTITUTE OF TECHNOLOGY

All members of The American Society of Mechanical Engineers and their guests are cordially invited to join with the Alumni of Stevens Institute of Technology in their annual theatre party on Friday evening, December 4, 1914, at the Knickerbocker Theater. After the show, there will be a supper and dance at the Hotel Astor. Tickets may be obtained from the Tyson Company, Hotel Astor. B. Franklin Hart, Jr., 50 Church Street, New York, is Chairman of the Committee in charge of the details.

WORCESTER POLYTECHNIC INSTITUTE

The Alumni of Worcester Polytechnic Institute will hold a banquet at the Machinery Club, 50 Church Street, New York, at 6.30 p.m. President Ira N. Hollis has promised to be present and Professor Harold B. Smith will make an address on Rambles in the Orient. Special arrangements are being made for a large reunion of all Worcester Polytechnic Alumni. F. O. Price, Pratt Institute, Brooklyn, has charge of the arrangements.

YALE UNIVERSITY

Tentative plans have been made for a reunion dinner to be held at the Yale Club. All graduates are invited to attend and participate in the formation of a Yale Engineering Society, which will take place on that evening. E. G. Williams, care of J. G. White Engrg. Corp., 43 Exchange Place, New York, will give desired information.

TRANSACTIONS AND THE JOURNAL

In accordance with the vote of the Council the annual volume of Transactions in the 6 by 9 size with the usual library binding will be issued to the entire membership during the coming year. This volume will cover the activities of the Society during the year ending with the present Annual Meeting.

In the January number of The Journal an Index for the twelve preceding numbers will be published, together with complete directions for binding.

COUNCIL NOTES

At a meeting of the Council on November 13, 1914, the reports of the Standing Committees were presented. These appear in this issue of The Journal.

The rules governing the award of the Henry Hess Prizes for Juniors and Student Members were approved as drafted by the Committee on Meetings and the chairman of the Committee on Student Branches.

It was voted to approve the formation of a student branch of the Society at Throop College of Technology, Pasadena, Cal.

The Committee on Constitution and By-Laws was requested to prepare amendments to the Constitution changing the present method of nominating officers.

The following Committee on Meetings in Milwaukee was approved: L. E. Strothman, Chairman; F. H. Dorner, Secretary; M. A. Beck, Henry Weickel, R. H. Robinson, W. C. Lindemann, Arthur Simons.

The Boiler Code again came up for discussion, and it was voted that the Code be reprinted after the insertion of certain corrections and that it be presented as a progress report at the Annual Meeting.

CALVIN W. RICE, *Secretary*.

HENRY HESS PRIZES FOR TECHNICAL PAPERS

In the March issue of The Journal was announced the generous gift of Mr. Henry Hess of $2000, the income to be used for the awarding of prizes for technical papers from Junior and Student Members. Such an award offers a valuable aid to the young engineer to undertake original work and is in line with the practice of many foreign societies.

Rules have been drawn up and approved by the Council with reference to the distribution of these prizes, those governing the Junior papers having been formulated by the Committee on Meetings and those for the Student papers by the Committee on Student Branches. It is the hope of the Council that there will be a large number of papers submitted for the decision of the Committee on Prizes.

The conditions governing the award are as follows:

COMMITTEE ON PRIZES FOR JUNIORS

(1) The Council shall appoint annually, not later than its regular meeting in January of each year, three members of the Society, not members of the Council, who shall form a Committee to recommend the award of prizes for Juniors during the year. This Committee shall include one member of the Meetings Committee of the Society.

(2) The papers considered shall include all papers presented to the Society by Juniors during the year ending with the month of August.

(3) The Committee on Prizes shall report its recommendation to the Council on or before October—the findings of the Committee shall be final. Prizes shall be awarded by the Council. The awards shall be announced at the Annual Meeting and shall also be published in The Journal.

(4) The Secretary of the Society shall act as Secretary to the Committee on Prizes, but shall not be a member of the Committee.

RULES OF AWARD

(1) The competition for the prize shall be restricted to the Juniors of the Society.

(2) The prize shall consist of fifty dollars in cash and an engraved certificate, signed by the President and Secretary of the Society.

(3) The prize shall be awarded for the best paper of the year, provided such paper shall be adjudged of sufficient merit as a contribution to the literature of the profession of Mechanical Engineering, but not otherwise.

(4) Papers to be eligible for competition must be the bona fide production of those contributing them and must not have been previously made public nor contributed to any other society in whole or in part.

(5) If in any one year, no award be made, it shall be in the power of the Committee to award in the following year or years the accumulated prizes to the authors of the different papers deemed of sufficient merit.

(6) These rules may be modified by the Council.

COMMITTEE ON PRIZES FOR MEMBERS OF STUDENT BRANCHES

(1) The Council shall appoint annually, not later than its regular meeting in January of each year, three members of the Society not members of the Council, who shall form the Committee of Award to recommend the award of prizes from the Henry Hess Fund for Members of Student Branches of the Society during the year. This Committee shall include the Chairman of the Standing Committee on Student Branches.

(2) The Honorary Presidents of the Student Branches submitting papers in competition shall be asked to sit as Advisory Members to the Committee on Award.

(3) The papers considered shall include papers submitted by Members of Student Branches in competition during the year ending on August 31.

(4) The Committee on Award shall report its recommendations to the Council on or before October 1. The findings of the Committee shall be final. Prizes shall be awarded by the Council. The awards shall be announced at the Annual Meeting and shall also be published in The Journal.

(5) The Secretary of the Society shall act as Secretary to the Committee on Prizes, but shall not be a member of the Committee.

RULES OF AWARD

(1) The competition for the prizes shall be restricted to enrolled members of the Student Branches of the Society in good standing.

(2) The two prizes shall consist of twenty five dollars each in cash, with an engraved certificate signed by the President and Secretary of the Society.

(3) The prizes shall be awarded for the best two papers presented during the year from October 1 to September 30 following, provided such paper shall be adjudged of sufficient merit to be a contribution to the literature of the profession of mechanical engineering, but not otherwise.

(4) Papers to be eligible to consideration in the competition must be the bona fide production of those contributing them; and must not have been made public nor contributed in whole or in part to any other body than the Student Branch in which they have originated.

(5) If no award of a prize is made in any year, it shall be within the power of the Committee on Award hereafter provided, to award in the following year or years the accumulated prizes to more than the two authors above specified, provided the papers in competition be deemed of sufficient merit.

(6) These rules may be modified by the Council, to take effect on the first of October next ensuing.

APPLICATIONS FOR MEMBERSHIP

Members are requested to scrutinize with the utmost care the following list of candidates who have filed applications for membership in the Society. These are sub-divided according to the grades for which their age would qualify them and not with regard to professional qualifications, i.e., the age of those under the first heading would place them under either Member, Associate or Associate-Member, those in the next class under Associate-Member or Junior, while those in the third class are qualified for Junior grade only. The Membership Committee, and in turn the Council, urge the members to assume their share of the responsibility of receiving these candidates into the Membership by ad-

vising the Secretary promptly of any one whose eligibility for membership is in any way questioned. All correspondence in regard to such matters is strictly confidential and is solely for the good of the Society, which it is the duty of every member to promote. These candidates will be balloted upon by the Council unless objection is received before January 10, 1915.

NEW APPLICATIONS

FOR CONSIDERATION AS MEMBER, ASSOCIATE OR ASSOCIATE-MEMBER

ALLEN, HARVEY, Development Engr., Pressed Steel Car Co., and Western Steel Car & Fdy. Co., Pittsburgh, Pa.

BARBA, WILLIAM P., Genl. Mgr., Midvale Steel Co., Philadelphia, Pa.

BRENZINGER, JULIUS, Vice-Pres. and Genl. Supt., Max Ams Mch. Co., Mt. Vernon, N. Y.

FOERSTERLING, HANS, Second Vice-Pres., The Roessler & Hasslacher Chemical Co., Perth Amboy, N. J.

FOORD, JAMES L., Ch. Inspector, Hartford Steam Boiler Inspc. & Ins. Co., Chicago, Ill.

GOLDSBOROUGH, WINDER E., Cons. Engr., 30 Church St., New York.

HARLEY, LEON J., JR., Pres., Harley Co., Springfield, Mass.

KELLEY, WM. D., Genl. Supt., Meters, Consolidated Gas Co. of N. Y., New York.

KNOWLTON, EDWARD K., Supt. of Pwr., Standard Oil Co., Bayonne, N. J.

LUCEY, EDMUND A., with H. L. Gantt, Cons. Engr., New York.

LUCKETT, GUSTAVUS T., Commercial Engr., The M. W. Kellogg Co., New York.

MACBETH, GEORGE T., Engr., Gas Dept., Westchester Ltg. Co., Mt. Vernon, N. Y.

MACINTOSH, WALTER L., Ch. Draftsman, Consolidated Gas Co. of N. Y., New York.

MAYLAND, G. ALFRED, Engr. & Ch. Draftsman, Los Angeles Gas & Elec. Corp., Los Angeles, Cal.

MILLIKEN, ALBERT D., Agent, Hamilton Mfg. Co., Lowell, Mass.

MILLS, ANSON C., Supt., Jackson Fence Co., Jackson, Mich.

MORHOUS, OAKLEY A., Chemist in Charge, Consolidated Laboratory, Consolidated Gas Co. of N. Y., New York.

MUSCHENHEIM, FREDERICK A., Vice-Pres., Hotel Astor, New York.

NEELAND, MARVIN A., Asst. to Vice-Pres., United States Steel Corp., New York.

NELSON, CHARLES, Ch. Engr. and Supt., Boiler & Fly Wheel Dept., Royal Indemnity Co., New York.

OAKLEY, CLIFFORD H., Principal Owner, Pres. & Factory Mgr., Essex Rubber Co., Inc., Trenton, N. J.

PRESSINGER, HARRY E., Deputy, Charge of Boiler Inspection, Industrial Commission of Wis., Milwaukee, Wis.

RADCLIFFE, ROBERT L., Mgr., St. Louis Office, Henry R. Worthington, St. Louis, Mo.

SCHAEFFER, CHARLES F., Prop. & Mgr., Schaeffer Mch. Wks., Philadelphia, Pa.

SCOFIELD, EDWARD H., Engr. of Pwr., Twin City Rapid Transit Co., Minneapolis, Minn.

SPEAR, MAYNARD H., Secy. & Genl. Mgr., New York & Queens Gas Co., Flushing, N. Y.

STEVENS, EVERETT M., Asst. Mgr. of Sales, Nashua Mch. Co., Boston, Mass.

TAPPAN, CHARLES O., Cons. and Constr. Engr., 2 Rector St., New York.

THOMAS, ALBERT C., Resident Ch. Engr., Alpha Portland Cement Co., Easton, Pa.

UNDERHILL, HENRY L., Asst. Engr. of Manufacture, Consolidated Gas Co. of N. Y., Astoria, L. I., N. Y.

WOODS, GEORGE E., Asst. Ch. Engr., Consolidated Gas Co. of N. Y., New York.

FOR CONSIDERATION AS ASSOCIATE-MEMBER OR JUNIOR

FRY, HENRY S., Div. Supt., H. C. Fry Co., Rochester, Pa.

JARLOW, CHARLES, Associate Prof. of Mech. Engrg., Oklahoma Agri. & Mech. College, Stillwater, Okla.

LESLIE, BERNARD S., Asst. to Supt. of Factory, United Shoe Mchy. Co., Beverly, Mass.

MACNAUGHTON, EDGAR, Instr. in Mech. Engrg., Tufts College, Tufts College, Mass.

FOR CONSIDERATION AS JUNIOR

CONNER, B. FRANKLIN, JR., Engr., Alberger Pump & Condenser Co., Newburgh, N. Y.

DALRYMPLE, PHILIP W., Ch. Engr., Factory No. 10, The Singer Mfg. Co., Bridgeport, Conn.

HERR, GEORGE D., Mech. Engr., Sayles Bleacheries, Saylesville, R. I.

MCKENDRICK, LESLIE, Engrg. Rep., Wheeler Condenser & Engrg. Co., New York.

MALONE, JOHN A., Asst., Standard Oil Co. of N. Y., Bombay, India.

PENNEY, CHARLES F., Sales Engr., Combusto Devices Corp., care R. Leudermann, New Haven, Conn.

APPLICATIONS FOR CHANGE OF GRADING

PROMOTION FROM ASSOCIATE

GRAVES, JAMES M., Supt., Pwr. Sta., Duquesne Light Co., Pittsburgh, Pa.

PROMOTION FROM JUNIOR

GREGER, HENRIK, Asst. Ch. Engr., Epping-Carpenter Pump Co., Pittsburgh, Pa.

MURRAY, ARTHUR F., Rep., International Steam Pump Co., St. Paul, Minn.

SEATON, ROY A., Prof., Kansas State Agricultural College, Manhattan, Kansas.

TRACY, LYNDON S., Mgr., Soda Ash Dept., The Solvay Process Co., Syracuse, N. Y.

SUMMARY

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REPORTS OF STANDING COMMITTEES

Presented at the Council Meeting, November 13, 1914

COMMITTEE ON CONSTITUTION AND BY-LAWS

The President appointed as members of the Committee on Constitution and By-Laws, Jesse M. Smith, Chairman, F. R. Hutton, Alfred Noble.

The Committee has recommended and the Council approved the amendments to By-Laws 2 and 3, whereby By-Law 3 is renumbered By-Law 2 as a more logical arrangement; former By-Law 2 is renumbered By-Law 3 and reworded, and permits the use of non-members as references for a candidate who is so situated as not to know or come in contact with members of the Society, yet in every other way is eligible to membership.

B 3 Applications for membership from candidates who may be so situated as not to be personally known to the necessary number of members of the Society may be recommended by the Membership Committee for ballot, after sufficient evidence has been secured to show that in its opinion the applicant is worthy of admission to membership. Such applicant for membership may refer to officers or voting members of other engineering societies of like standing.

The Amendments to the Constitution as announced by ballot at the Spring Meeting in St. Paul-Minneapolis are now in effect, and are as follows:

C 9 A Member shall be an Engineer or Teacher of Applied Science of thirty-two years of age, or over, and shall have been in the active practice of his profession for at least ten years and in responsible charge of important work for five years, and shall be qualified to design as well as to direct engineering work. Fulfilling the duties of a Professor of Engineering who is in charge of a department in a college or school of accepted standing shall be taken as an equivalent to an equal number of years of active practice. Graduation from a school of engineering of recognized standing shall be considered as equivalent to two years of active practice.

C 11 An Associate-Member shall be a professional engineer not less than twenty-seven years of age, who shall have been in the actual practice of his profession for at least six years, and who shall have had responsible charge of work as principal or assistant for at least one year. Graduation from a school of engineering of recognized reputation shall be considered as equivalent to two years' active practice.

Respectfully submitted,

JESSE M. SMITH, *Chmn.* } *Committee on Constitution and By-Laws*
FREDERICK R. HUTTON }

REPORT OF FINANCE COMMITTEE

Your Finance Committee reports that the income of the Society for the year ending September 30, 1914, was $125,454.11; the total expenditures chargeable to income, $116,001.67, leaving an excess over income of $9,452.44. Of this amount, it is recommended that $1000 be reserved for distributing Vol. 35 of the Transactions and $3500 for completing the September 1914, issue of Condensed Catalogues, leaving $4,952.44, which it is recommended be turned into reserve fund. It is further recommended that all appropriations in excess of actual expenditures be cancelled.

Your Finance Committee recommends for the budget for the year to end September 30, 1915, as follows:

Finance Committee	$26,960
Membership Committee	2,000
Increase of Membership Committee	5,000
Council	7,500
House Committee	1,750
Meetings Committee	7,200
Publication Committee	55,500
Research Committee	100
Public Relation Committee	500
John Fritz Medal	150
Engineering Congress	2,000
Sales	8,000
Total	$116,660

It is estimated that the income will be $130,500.

It has been the policy of the Finance Committee to regulate the disbursements of the Society each year so that they will be but 90 per cent of the income. During the year just closed, these expenses amounted to approximately 95 per cent of the income.

On an expected income for the current fiscal year of $130,500, the aggregate of appropriations is $116,660, or approximately 90 per cent. It should be understood that as the year progresses, if the income of the Society shall give evidence of exceeding the above estimate, then, in case of necessity, appropriations may be increased; but if, on the other hand, there will be evidence of a falling off in the estimated income, the activities of the Society should be regulated so that the expenses will, as far as possible, be proportionately decreased.

Appended will be found a report of the accounts of the Society as shown in the books for the fiscal year ending September 30, 1914.

Respectfully submitted,

R. M. DIXON, *Chmn.*
W. H. MARSHALL
H. L. DOHERTY
W. L. SAUNDERS
W. D. SARGENT
} *Finance Committee*

APPENDIX TO REPORT

October 14, 1914

MR. R. M. DIXON,
CHAIRMAN, FINANCE COMMITTEE

Dear Sir:—

In accordance with your instructions, we have examined the books and accounts of The American Society of Mechanical Engineers, for the twelve months ended September 30, 1914.

The results of this examination are set forth in the three exhibits, attached hereto, as follows:

Exhibit A Balance Sheet, September 30, 1914.
Exhibit B Income and Expenses for the twelve months ended September 30, 1914.
Exhibit C Receipts and Disbursements for the twelve months ended September 30, 1914.

We hereby certify that the accompanying Balance Sheet is a true exhibit of its financial conditions as of September 30, 1914, and that the attached statements of Income and Expenses, and Receipts and Disbursements are correct.

Respectfully submitted,

WM. J. STRUSS & CO.
Certified Public Accountants

EXHIBIT A

BALANCE SHEET, SEPTEMBER 30, 1914

ASSETS

Equity in Society's Building (No. 25 to 33 W. 39th St.)	$353,346.62	
Equity one-third of Cost of Land (No. 25 33 W. 39th St.)	180,000.00	
		$533,346.62
Library Books	13,000.00	
Furniture and Fixtures	5,000.00	
		18,000.00
Stores, including Plates and Finished Publications		16,581.61
Trust Fund Investment		
New York City 3½% Bonds 1954 (Par $45,000)	$39,696.81	
St. Louis, Peoria & N. W. 1st 5's 1948 (Par $10,000)	10,613.89	
Cash in Banks representing Trust Funds	31,977.41	
		82,288.11
Cash in Banks for General Purposes	$7,374.92	
Petty Cash on hand	500.00	
		7,874.92
Accounts Receivable		
Membership Dues	$10,079.79	
Initiation Fees	4,080.00	
Sales of Publications, Advertising, etc.	21,960.46	
Total		36,120.25
Advance Payments		1,569.52
		$695,781.03

LIABILITIES

Certificates of Indebtedness		$60,300.00
Trust Funds		
Life Membership Fund	$43,500.00	
Library Development Fund	4,902.71	
Weeks Legacy Fund	1,957.00	
Initiation Fee Fund	29,928.40	
Henry Hess Prize for Juniors	1,000.00	
Henry Hess Prize for Students	1,000.00	
		82,288.11
Dues Paid in Advance		1,951.75
Initiation Fees Uncollected		4,080.00
Initiation Fees paid before due		25.00
Unexpended Appropriation 1913-14		4,704.39
Unappropriated Revenue 1913-14		4,748.05
U. S. Internal Revenue Account		10.64
Accounts Payable		3,905.28
		$162,013.22
Capital Investment	$491,046.62	
Surplus and Reserves	42,721.19	
		533,767.81
		$695,781.03

EXHIBIT B

INCOME AND EXPENSES, FOR THE 12 MONTHS ENDED SEPTEMBER 30, 1914

INCOME

Membership Dues	$73,541.35	
Sales, Gross Receipts	10,055.42	
Advertising	39,578.99	
Interest and Discount	2,278.35	
Total		$125,454.11

EXPENSES

Finance Committee	$23,003.91	
Membership Committee	2,138.47	
Council	7,169.31	
Increase of Membership Committee	6,182.93	
House Committee	2,270.49	
Library Committee	4,127.50	
Meetings Committee	7,379.51	
Publication Committee	56,205.24	
Advertising	22,343.76	
Journal Text	21,084.15	
Revises	181.57	
Transactions	8,694.64	
Year Book	3,901.12	
Research Committee	18.11	
Boiler Specifications Committee	1,227.35	
Power Test Committee	895.61	
German Resolution Fund and Dinner	281.48	
Annual Meeting Social	182.74	
Sales Expenditures	6,419.02	
Engineering Congress	1,250.00	
Total	$118,751.67	
Expenses Chargeable to Reserve	2,750.00	
		116,001.67
Excess of Income over Expenses		$9,452.44

$1000.00 to be reserved for distributing Vol. 35 Transactions.
$3500.00 to be reserved for completing Sept. 1914, Condensed Catalogues.

EXHIBIT C

RECEIPTS AND DISBURSEMENTS FOR THE 12 MONTHS ENDED SEPTEMBER 30, 1914

RECEIPTS

Membership Dues	$69,516.27	
Initiation Fees	27,085.00	
Membership Dues, Initiation Fees paid in advance	2,546.93	
Sales of Publications, Badges, Advertising, etc.	41,667.19	
Interest	3,414.49	
U. S. Internal Revenue	10.76	
	$144,240.64	
Cash in Banks and on hand General and Trust Funds, September 30, 1913	39,905.52	
		$184,146.16

DISBURSEMENTS

Disbursements for general purposes	$117,108.13	
Bonds Purchased	19,385.70	
Certificates of Indebtedness Redeemed	7,800.00	
	$144,293.83	
Cash in Banks and on hand General and Trust Funds, September 30, 1914	39,852.33	
		$184,146.16

REPORT OF THE HOUSE COMMITTEE

Again as in recent years, the House Committee, in addition to its routine duties, was responsible for the manage-

ment and conduct of the President's reception on the occasion of the Annual Meeting of 1913.

Several new portraits of honorary members have been hung in the Secretary's office and the collection is now practically complete.

The office equipment has been augmented by the addition of several desks, filing cabinets and the replacing of worn typewriters, etc.

The inventory of the pictures, equipment, books, stores and publications belonging to the Society, begun in February 1913, has been maintained and brought up to date.

Plans have been formulated for certain alterations in the Society's rooms whereby three rooms will be thrown into one large room for use as a business office by the Society, but the work has been deferred until more favorable times.

Respectfully submitted,

H. R. Cobleigh, *Chmn.*
S. D. Collett
W. N. Dickinson
F. A. Scheffler
J. W. Nelson

House Committee

REPORT OF THE LIBRARY COMMITTEE

It is with deep regret that the Library Committee is obliged to report the death of one of its most valued members, Mr. Alfred Noble, on April 19, 1914. From the organization of the Library Board of the United Engineering Society he took the liveliest interest in the library, devoting much time and thought to its activities. The Board has adopted appropriate resolutions, an engrossed copy of which has been presented to Mr. Noble's family.

During the year ended September 30, 1914, there has been added to the library of the Society, 1039 volumes and 185 pamphlets. Of the bound volumes, 303 were purchased, 302 were received in exchange for The Journal and Transactions, and 327 were presented. The pamphlets were largely received in exchange.

The attendance during the year has substantially increased; 13,485 persons used the library during the year, as compared with 10,357 last year, a gain of about 30 per cent. The library hours have been extended until 10 p.m., instead of 9 p.m., and the evening attendance has proportionately increased.

A catalogue of the sets of technical periodicals in the libraries of New York and vicinity is nearing completion. It will be ready for the printer about January 1, 1915.

A large amount of research work has been carried on, in the preparation of reference lists for members and others.

Respectfully submitted,

Leonard Waldo, *Chmn.*
Jesse M. Smith
W. M. McFarland
J. W. Lieb, Jr.
The Secretary

Library Committee

REPORT OF THE COMMITTEE ON MEETINGS

During the year 1913-1914 the Committee on Meetings has met six times and purposes to hold several more committee meetings before the Annual Meeting of the Society in December. One of the important features of this year's work has been the unusually early preparation of the programs of the Spring and Annual Meetings of this year and the Spring Meeting of 1915. This action has been taken with the belief that through it a better average quality of papers and more comprehensive treatment of subjects can be obtained. This has involved somewhat more work during this year than usual, but this will clear the ground for a continuation of the policy in the future, without unusual effort. This policy follows the admirable example set by some of the great British societies.

Three professional sessions were arranged for at the Spring Meeting in St. Paul and Minneapolis: one was a symposium dealing with the use of powdered coal fuel; another was devoted to miscellaneous papers; the third related to engineering work in the vicinity of the Twin Cities. The papers for this last session were solicited by the Local Committee, and it is a pleasant duty to acknowledge the hearty coöperation of its members.

The plans for the Annual Meeting were worked out as early as January 2, 1914, and a tentative program published in the February issue of The Journal. A request was made to have as many of the papers as possible in the hands of the Committee by September 1, or immediately thereafter. At the date of writing this report (October 1), the greater part of the papers for the Annual Meeting have been received, and many of these have already received final action.

Committee meetings between this date and the Annual Meeting will be devoted largely to the program for the Spring Meeting of 1915.

The importance and value of the work of the sub-committees is becoming more and more evident. In working out the program for the Annual Meeting, the coöperation of four sub-committees deserves especial mention and a large measure of appreciation, namely, that of the Machine Shop Practice, Railroads, Hoisting and Conveying, and Iron and Steel Committees.

In addition, the standing Committee on Public Relations has carried forward the preparations for one session to be devoted to the subject of the Engineering in Connection with the Administration of Cities.

The results of the past year, combined with former accumulated experience in the work of sub-committees and their relations to the Committee on Meetings, show the need of a more clearly defined policy to bring about uniformity of action and the largest measure of effectiveness in those relations. To point out a single feature, there should be a uniform time and method for reconstituting the membership of the sub-committees. This will bring more of our members into active Society work and should tend to enrich and increase the technical value of the papers and reports brought forth.

The committee feels compelled to point out that the rapidly growing membership of the Society requires a more and more diversified engineering program for the meetings, and this in turn requires increasing appropriations to carry on the work.

Respectfully submitted,

L. P. Alford, *Chmn.*
H. E. Longwell
H. L. Gantt
R. H. Fernald
J. H. Barr

Committee on Meetings

REPORT OF COMMITTEE ON MEMBERSHIP

During the past year the Committee on Membership has held 12 meetings for the transaction of its work.

The number of applications acted upon during the fiscal year 1913-14 are as follows:

Applications pending October 1, 1913	329
Applications received during fiscal year	1192
Total	1521

Of these applications the following action was taken:

Recommended for membership	1318
Withdrawn for various reasons	1
Deferred indefinitely	9
Denied promotion	2
Deferred for special investigations	18
Irregular course of procedure	143
Total	1521

This total was divided into the following gradings:

Members	588
Promotions to Member	81
Associates	59
Associate-Members	245
Promotion to Associate-Members	57
Juniors	288
Total	1318

It was also voted to recommend to the Council the reinstatement of 15 members.

The Committee maintained and continued the careful scrutiny of the past in the admission of members and yet has simplified and standardized the procedure so that the cost has been reduced. The success may be measured by the following figures:

Year	Cost	No. Applications	Cost, each	Reduction, Per Cent
1911–1912	$3567	694	$5.14	..
1912–1913	3281	868	3.78	26
1913–1914	2171	1330	1.63	68

During the year the Committee voted against granting the Junior grade to any applicant thirty years of age or over on the ground that a candidate who at thirty years of age does not possess qualifications for a grade higher than Junior will not be a credit to the Society or help to keep up the present high standard of membership.

During the year a woman was admitted to membership for the first time in the history of the Society.

It will be observed that the number of applications greatly exceeds the numbers of previous years, and that the applicants include many prominent engineers. The Society is being strengthened thereby and aided towards a much needed occupation of the wider fields of activity appropriate to the profession. For this growth of numbers we are all largely indebted to the fruitful activities of the Committee on Increase of Membership and its Chairman.

Respectfully submitted,

THEO. STEBBINS, *Chmn.*
W. H. BOEHM
H. C. MEYER, JR.
L. R. POMEROY
HOSEA WEBSTER
Membership Committee

REPORT OF THE PUBLICATION COMMITTEE

In accordance with the recommendations of the Committee in its last annual report, several important changes in the publications of the Society were effected in January 1914. For several years the Publication Committee has sought to devise a plan which would eliminate the duplicate publication of papers in the Transactions and in The Journal. In October 1913 the Committee presented a plan to the Council providing for the increase in size of The Journal and the abolishment of the Transactions, with the recommendation that the question of abolishing the Transactions be referred to the members. The Council approved the entire recommendations except the referendum to the members.[1]

The result has been the issuing of The Journal in its new form in the 9 in. by 12 in. size, which is gradually becoming the standard for technical periodicals. The matter in The Journal is so arranged that the papers and discussions are brought together in the same issue after a meeting instead of being separated in different issues as heretofore. When published in this manner The Journal becomes the Transactions of the Society and has the advantage of bringing the reports of meetings to the attention of the membership when the matter is new, instead of a year after presentation.

In its mechanical make-up, The Journal is produced in sections to facilitate binding. The first part contains information upon Society affairs and announcements of meetings. Previous to the Annual and Spring meetings abstracts are published of the papers to be presented so that members may be informed and may send for such pamphlet copies of the papers as they may desire. The second section contains the papers and discussion given at meetings, after which is the Foreign Review Section.

A gratifying commentary on the foregoing plan has been the recent adoption by the British Institution of Mechanical Engineers of the same plan, except that the small size of page has been maintained for their Journal.

An alternative plan preferred by Mr. Low of the Committee, outlined in The Journal for April 1914, has been carefully considered. This involves:

a Printing the papers separately, as usual, for distribution before the meeting

b Making The Journal's treatment of the papers and the meetings a readable account of what they contain and accomplish

c Binding the papers separately in paper covers, each with its discussions, rather than binding them all together in the Transactions

Members will be advised in The Journal of the papers which are to be presented at a coming meeting and can obtain gratis copies of any or all of them by addressing the Secretary. They will thus have in The Journal (*a*) a copy of each paper in full or in abstract; (*b*) an account of its presentation at the meeting and of the discussion which it brought forth; and in addition they can have upon request (*c*) complete finished copies of the papers neatly bound with their discussions.

A member who wants to keep the Transactions as he has been doing can simply request a copy of each paper presented during the year with its discussions, and get them bound in the style of former years. Those who want to specialize more can order the papers in which they are especially interested, and bind or file them as they see fit. Papers upon the same or similar subjects can be bound together into monographs or symposiums, and in addition the members can bind their Journals if they wish, either in whole or in part, provision having been made in the paging for eliminating conveniently the several departments and the matter of merely present or passing interest.

[1] The Council at its October meeting voted to issue Transactions in the usual form in 1915.

During the year approximately 75 letters of criticism have been received from the membership of 5500 and in three cases from groups of members, in which the chief objections have been the abolishment of the bound volumes of Transactions and the fact that if bound copies of The Journal were to constitute the Transactions, they would be an inconvenient size for book shelves. Although the number of objections is small in proportion to the membership, the earnestness of the communications and the preference expressed in them for the established custom of issuing Transactions in an annual volume convinces the Committee that the decision to retain or discontinue the annual volume should be made by the membership at large.

The Committee has made such provision that the continuance of Transactions in its old form shall be possible. The volume has recently been issued for 1913-1914 and throughout the year the papers have been printed in pamphlet form in the small size and the type kept standing. These pamphlets are available for a 1914-1915 volume of Transactions, should the Council or the membership so elect.

The Index for the first 35 volumes of Transactions, with the exception of Vols. 31, 32 and 33, which was prepared for the printer over a year ago, is still unpublished because of the lack of funds at the disposal of the Committee.

Respectfully submitted,

CHAS. I. EARLL, *Chmn.*
GEO. M. BASFORD
I. E. MOULTROP
FRED. R. LOW
FRED J. MILLER
Publication Committee

REPORT OF THE RESEARCH COMMITTEE

During the year, the Committee has appointed, subject to the approval of the Council, a committee on research into the subject of Fuel Oils.

This committee has organized and begun work, but no results have been obtained which are sufficient to warrant a report. The committee is, however, active and enthusiastic, and it is expected that it will be able to show at the end of another year excellent results.

The Sub-Committee on Safety Valves, appointed by the Committee and sanctioned by the Council, organized with P. G. Darling as chairman. In response to a request for a report of the activities of the sub-committee, Mr. Darling writes that his location for the ensuing year will be so inaccessible that he will be unable to take part in the activities of the committee, and that Edward F. Miller has been appointed as chairman pro tem. Professor Miller reports that considerable work has been done and that a more complete report will be made later.

The Sub-Committee on Materials of Electrical Engineering, consisting of Ralph D. Mershon, reports that Professor Boyd of the Ohio State University has been doing, on the request of the committee, some experimental work on porcelain and other ceramic material in order to determine their mechanical characteristics.

The Sub-Committee on Steam has not been able to make any progress during the year on account of the absence of material.

So far as the activities of the Research Committee itself are concerned, a communication was recently received from an engineer of the highest standing, who desires to make research on the properties of worm gearing. Correspondence on this subject has been taken up with a prominent manufacturer, and, under certain conditions, the assent of this company has been secured to a monetary contribution. The matter is being actively prosecuted and it is believed that funds can be secured for this investigation.

The membership of the Society does not seem to appreciate the existence of the Research Committee or avail itself of the facilities which the Committee offers. Great activity has been shown by various members of the Committee and its sub-committees in the suggestion of directions in which the work of the Committee could be carried on, but these suggestions on the whole have not borne definite fruit. The Research Committee feels that if it is to be of real use to the Society the stimulus to such use must come from the members themselves in bringing before the Committee problems which need solution, and in notifying the Committee of desire to make investigations, and taking advantage of the Committee's facilities for enlisting the cooperation, both financial and otherwise, of manufacturers and others interested in the subjects under investigation.

Respectfully submitted,

RICHARD H. RICE, *Chmn.*
A. L. DE LEEUW
ROLLA C. CARPENTER
RALPH D. MERSHON
Research Committee

REPORT OF PUBLIC RELATIONS COMMITTEE

Arrangements are being made, for conducting, under the guidance of the Committee, a session of the Society to be held at the coming Annual Meeting, at which session subjects dealing with the relation of the engineer to public work, and especially to such engineering work as is done by municipalities, will be presented and discussed, not from the political point of view, but from the engineer's side.

This action has been taken by the Committee in the belief that the Society should take note of the fact that the engineer is being more and more recognized as a very important factor in conducting such work as is done by municipalities in the interest of the public; that the day has gone by when his only function will be employment as a consultant or expert; and that he will be increasingly called upon to serve in positions of general executive character where his training and special knowledge will be available and can be applied in direct service to the public.

The Committee believes that it will be wise for the Society, while avoiding the discussion of the political side of this matter, to recognize the facts of the situation and to advance, so far as may be possible, this general movement toward a greater recognition of the valuable services that can be rendered by engineers in executive positions.

Respectfully submitted,

FRED J. MILLER, *Chmn.*
JAS. M. DODGE
WORCESTER R. WARNER
GEO. M. BRILL
MORRIS L. COOKE
Public Relations Committee

THE JOURNAL OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

INCLUDING THE TRANSACTIONS OF THE SOCIETY

DECEMBER · 1914

ANNUAL MEETING, NEW YORK CITY, DECEMBER 1-4

WHY ATTEND THE ANNUAL MEETING

The program for the 35th Annual Meeting (see Page IV) includes a number of subjects of particular interest to the various industries of the country—*Boiler Code, Building Construction, Management, Grinding, Steam Locomotives, all-day session on Engineering in the Administration of a City, Iron and Steel, Air Compressors, etc.*—and on December 1-4 the Headquarters of the Society will be the rendezvous of the mechanical engineering profession.

The following analysis shows the various divisions of engineering work represented by our membership:

Executives: President, Vice-President, Treasurer, Director, Member of Firm, General Manager	1202
Consulting Engineers, Contracting and Constructing Engineers	566
General Superintendent, Superintendent, Assistant Superintendent, Mechanical Superintendent	615
Chief Engineers, Assistant Chief Engineers	361
Mechanical Engineers, Engineers, Assistant Engineers	1900
Chief Draftsmen, Assistant Chief Draftsmen, Designing Engineers, Estimators	326
Managers, Assistant Managers, Sales Managers, Sales Engineers	594
Other classifications	440
Total membership, November 1, 1914	6004

No member can fail to profit by the opportunity afforded for making new acquaintances and renewing old friendships among this great body of engineers, and all should take advantage of the excellent opportunity afforded to extend the hospitality of the Society to professional associates and acquaintances.

Advertising Section

1. Display Advertisements - Page 1

2. Classified List of Mechanical Equipment - - - Page 39

3. Alphabetical List of Advertisers - - - Page 51

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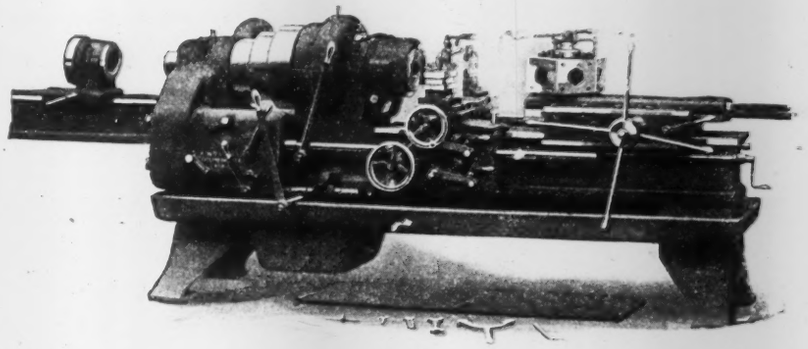

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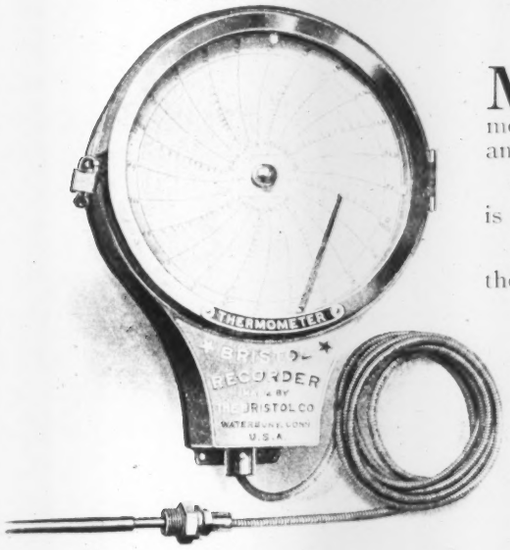

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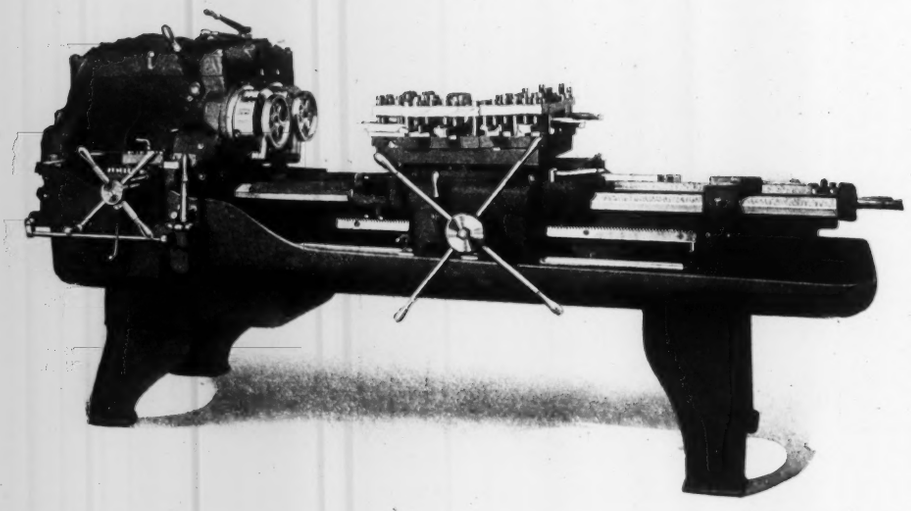

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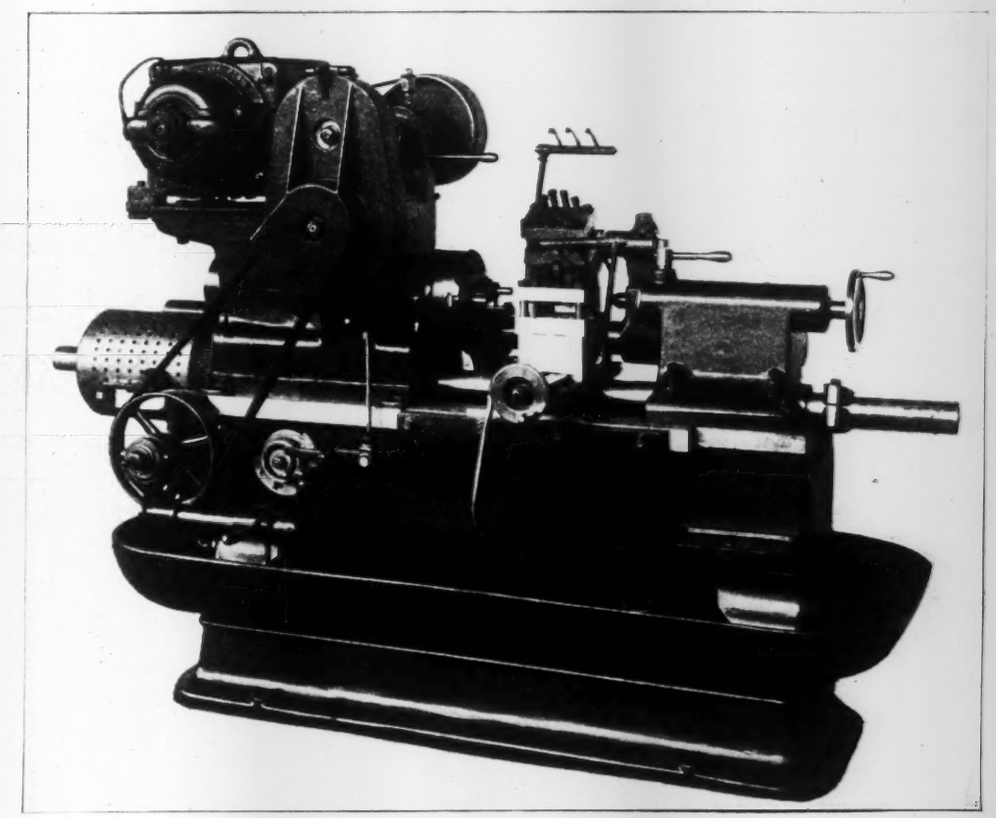

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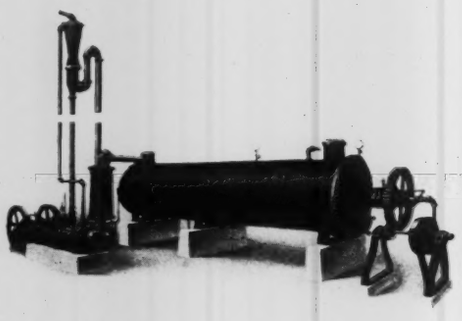

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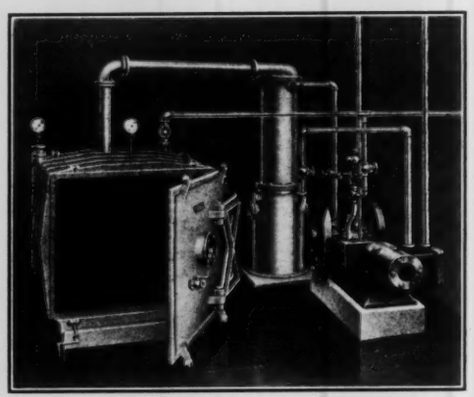

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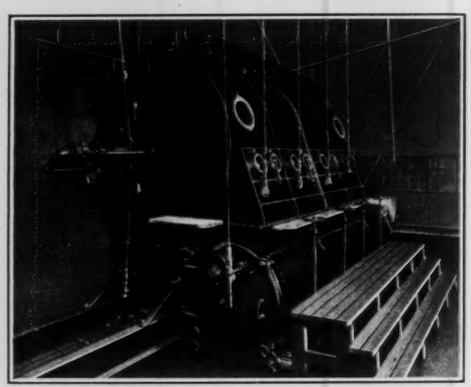

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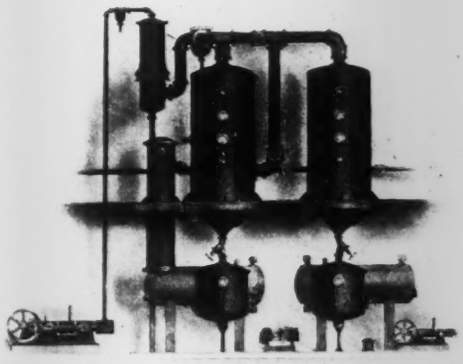
best fitted for your work. Guess work, conjecture, and approximation *do not* enter into the making of Devine Dryers and Evaporators. Every modification of general design, every improvement in detail is based on *known* facts. "Devine" Vacuum Apparatus on this continent and "Passburg" in Europe are synonymous and have proven by world wide use to be the most efficient—most economical.

If you are considering new or additions to your present equipment, let us co-operate with you to determine the most efficient type of apparatus suited to your needs.



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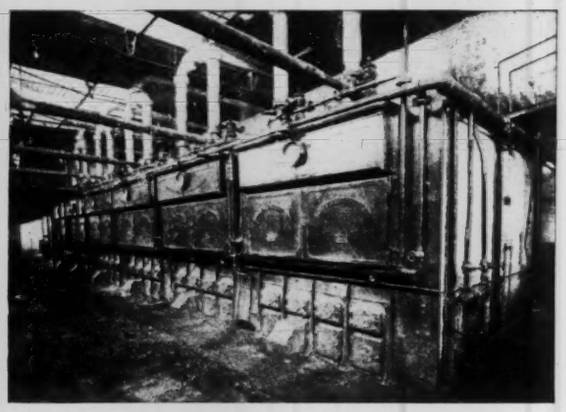
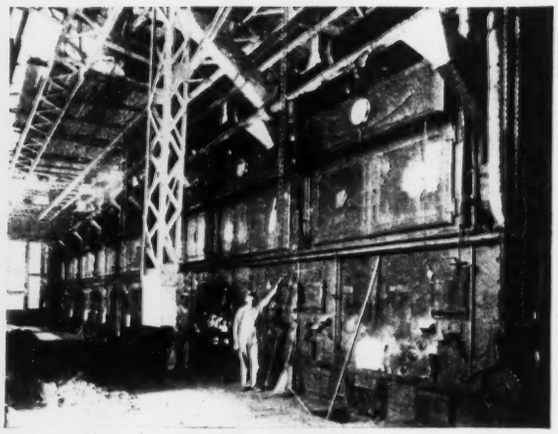
HEINE



Seven of ten 320 H.P. Heine Boilers, Warren Mfg. Co., Warren, R. I.



Seven 350 H.P. Heine Boilers at U. S. Navy Yard, Norfolk, Va.

To Eliminate Air Infiltration Use Heine Boilers

TESTS reported in the January 13, 1914, issue of *Power*, show the effect of air infiltration on boiler efficiency. Leakage through clean-out doors and cracks in the side walls of the setting caused the average CO_2 for 27 days at the top of the last pass to be 4.2% lower than the CO_2 at the top of the first pass. The average percentages of CO_2 were 13 and 8.8%. The difference corresponds to an increase in excess air of 75% and a loss of fuel of approximately 5½%.

The infiltration of air through brick settings can be largely prevented by careful pointing up and painting with asphaltum base paint. With boilers with side clean-out doors, special attention must be paid to the door frames which work loose and to the doors.

With the Heine Boiler there are no openings in the side walls of the setting, and therefore the task of maintaining the setting tight and free from air inleakage is greatly simplified. Furthermore any desired number of boilers may be set in a solid battery and the work of maintaining air tight settings concentrated on the end walls of the battery.

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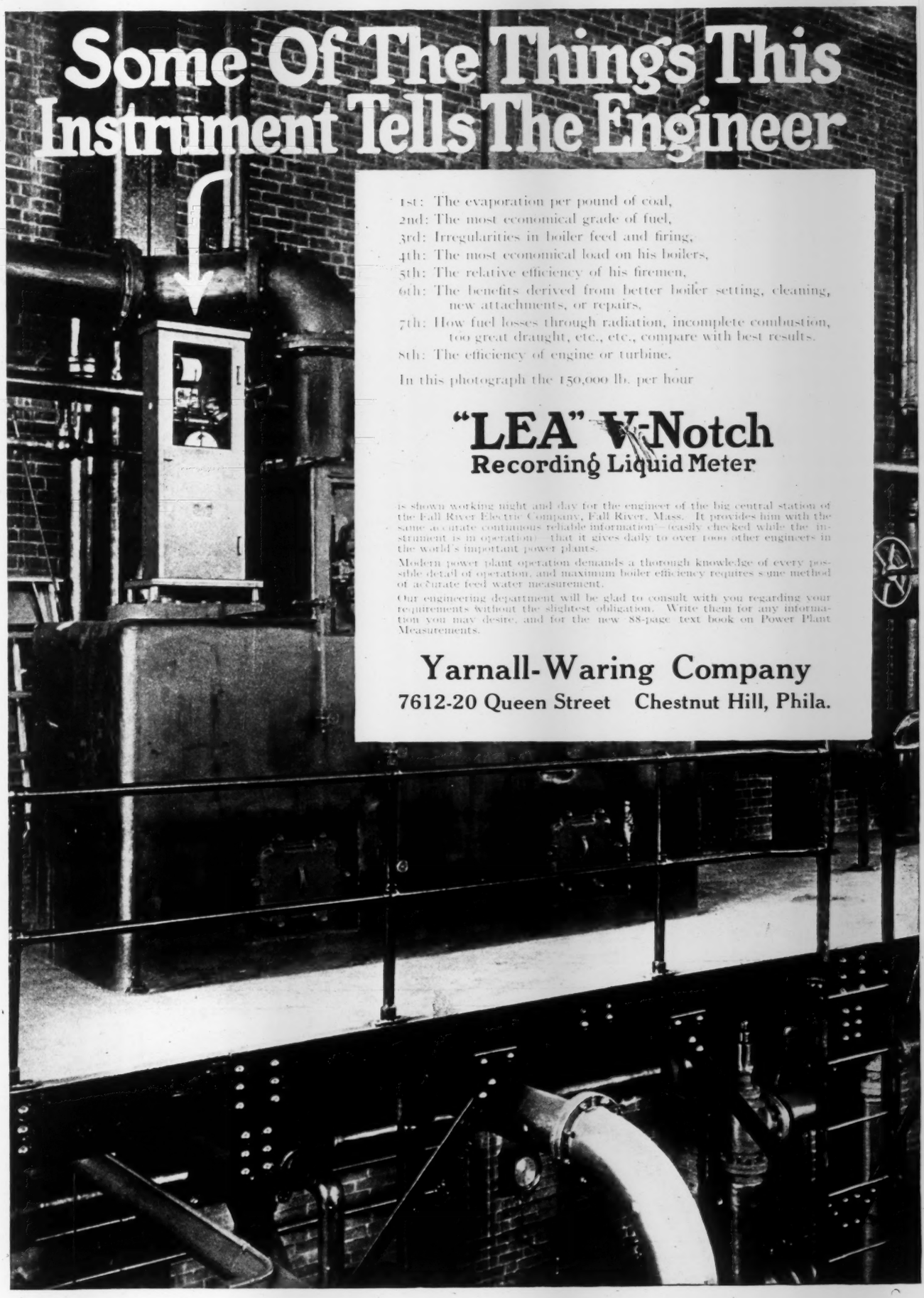

Some Of The Things This Instrument Tells The Engineer

1st: The evaporation per pound of coal,
2nd: The most economical grade of fuel,
3rd: Irregularities in boiler feed and firing,
4th: The most economical load on his boilers,
5th: The relative efficiency of his firemen,
6th: The benefits derived from better boiler setting, cleaning, new attachments, or repairs,
7th: How fuel losses through radiation, incomplete combustion, too great draught, etc., etc., compare with best results.
8th: The efficiency of engine or turbine.

In this photograph the 150,000 lb. per hour

"LEA" V-Notch
Recording Liquid Meter

is shown working night and day for the engineer of the big central station of the Fall River Electric Company, Fall River, Mass. It provides him with the same accurate continuous reliable information—easily checked while the instrument is in operation—that it gives daily to over 1000 other engineers in the world's important power plants.

Modern power plant operation demands a thorough knowledge of every possible detail of operation, and maximum boiler efficiency requires some method of accurate feed water measurement.

Our engineering department will be glad to consult with you regarding your requirements without the slightest obligation. Write them for any information you may desire, and for the new 88-page text book on Power Plant Measurements.

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Balance Fixed Charges and Operating Expense—

In the interests of the retaining company, the consulting engineer has before him the problem of balancing fixed charges and operating cost in the power station he designs. Balancing them so that each offsets the other to produce future power at the lowest cost per year.

A multitude of elements enter into this balancing. For one thing, the future in power station design must be considered not as a stationary repetition of years, but as a potential growth. This is why

The Taylor Stoker

demands most serious investigation by any engineer or engineering corporation concerned in steam power development. Because—

(1) THE TAYLOR STOKER reduces the initial cost to the minimum consistent with a guarantee of reserve capacity for near future increase in load.

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Ask any plant TAYLOR-equipped what its experience is with regard to the two elements of fixed charges and operating expense, viewed in the light of an increasing power load. We will give you a list.

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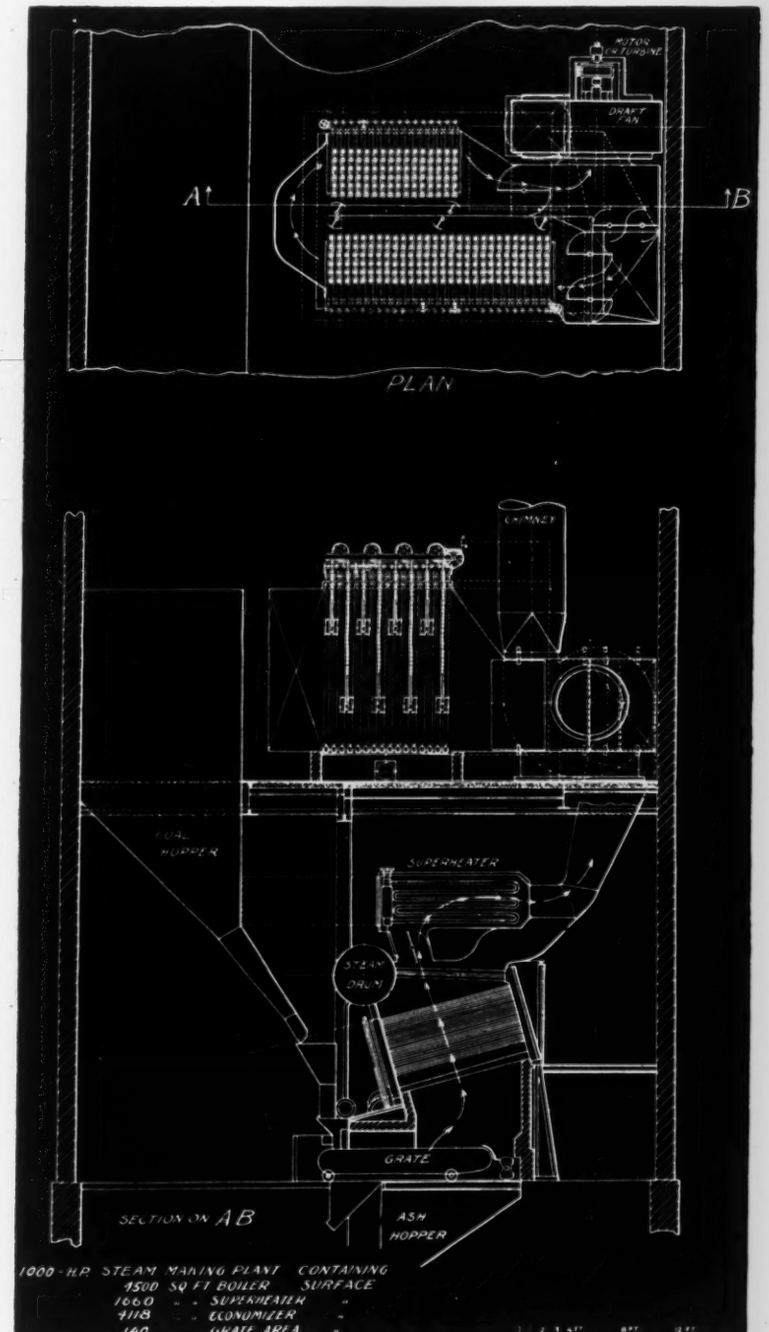
Is Essential in the Modern Steam Plant



MORE steam can be produced from less fuel and at less total cost by means of Green's Economizer.

Boiler surface should be used only for transferring the heat of evaporation, the water being brought up nearly to the boiling point and more advantageously by the economizer surface.

The Economizer is able to extract more heat from the gases than could the boiler surface, no matter how far extended, since the economizer contains water at hot well temperature, whereas the boiler contains water at a temperature corresponding to the steam temperature, that is, nearly 300° hotter. As the flow of heat from the gases to the water is proportional to the difference in temperature, a square foot of economizer surface abstracts heat from the gases much more actively than would a square foot of boiler surface located at the same point in the travel of the gases.

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Builders of Green's Economizer, Mechanical Draft Apparatus, Motors, Turbines and Steam Engines. Fans for all commercial purposes.

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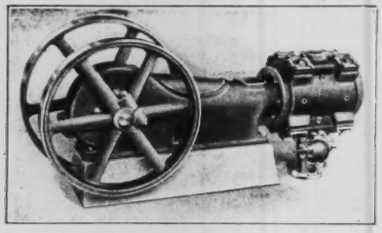

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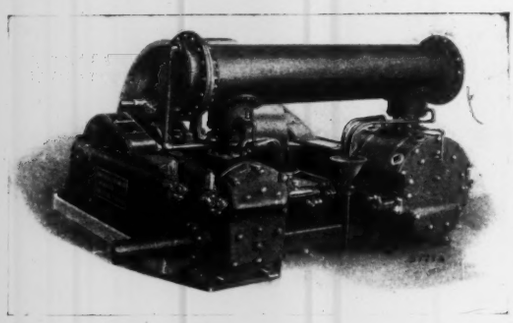

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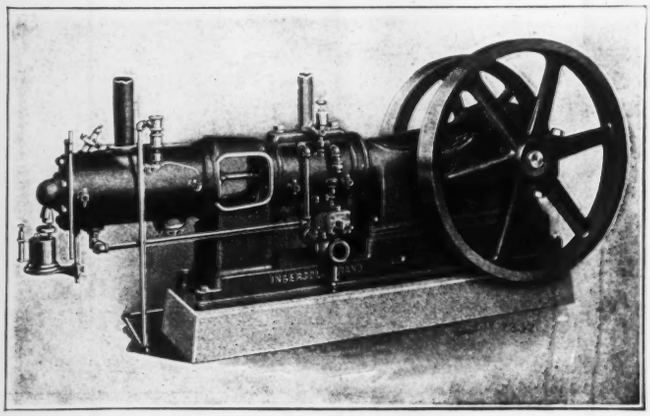

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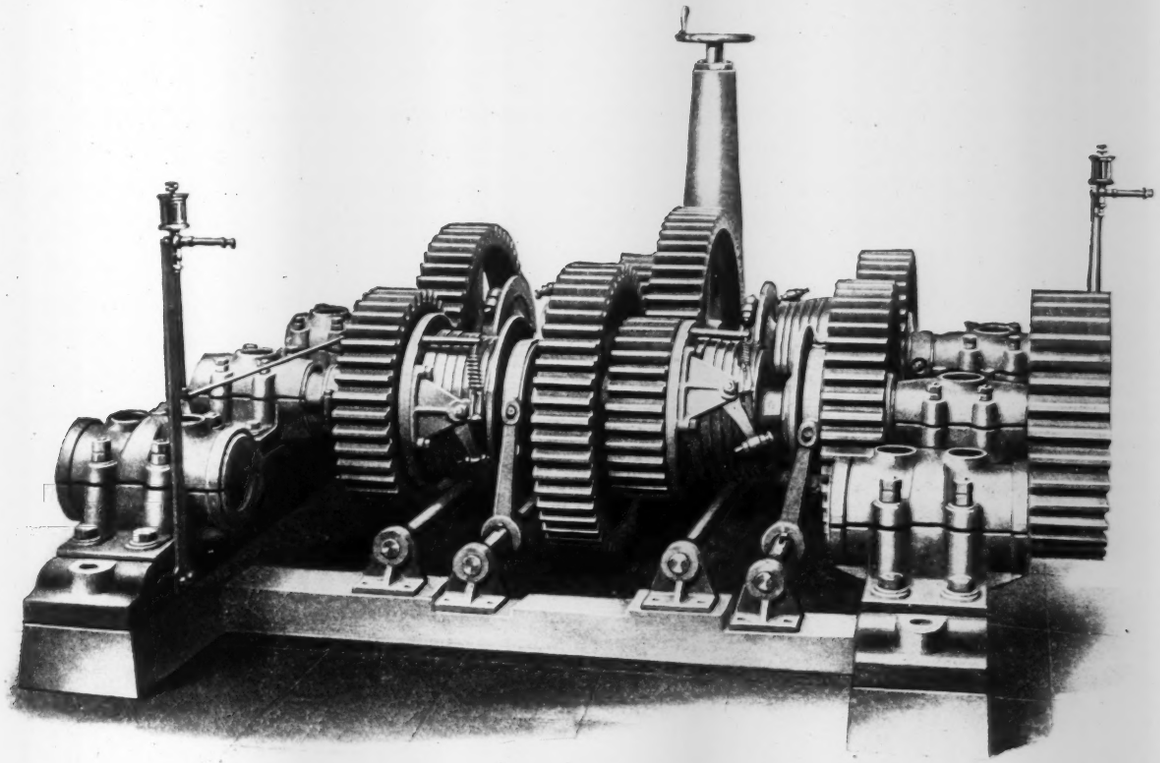

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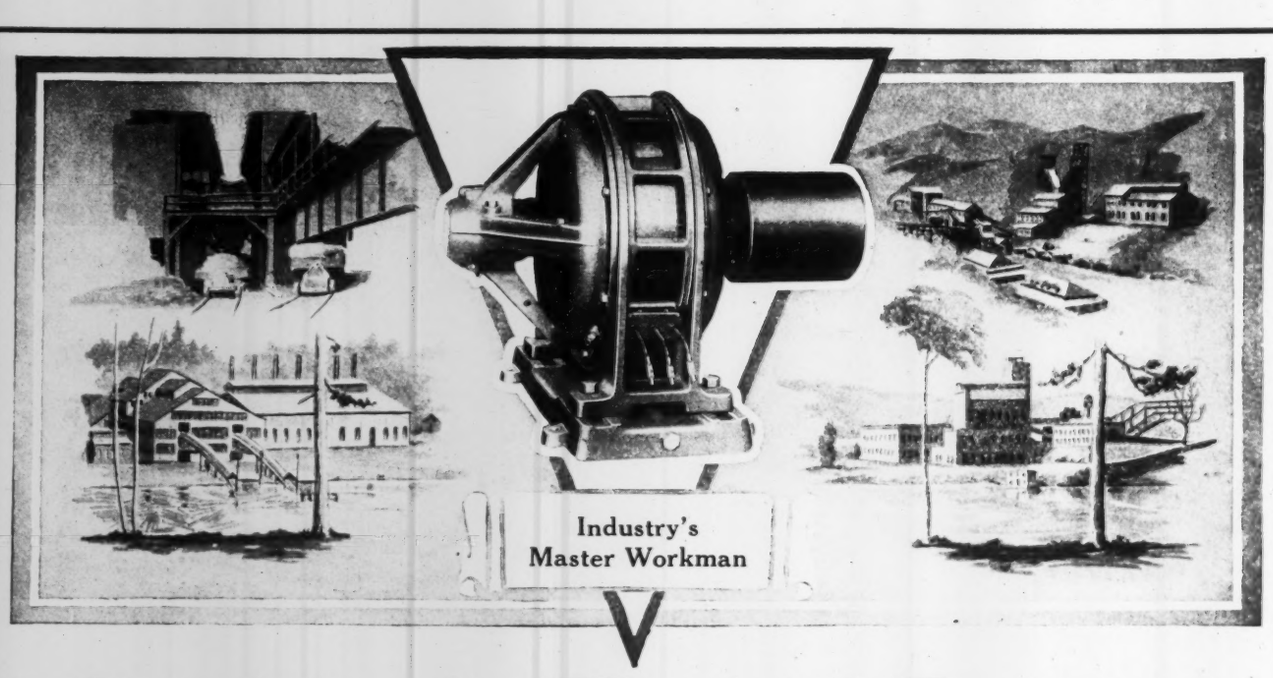

Getting the Utmost Return From Invested Capital

Capital and labor conditions make efficiency imperative. Every machine in a factory, every foot of its floor space, every employee must yield a maximum return on the investment.

One device or method will save at this point, another at that, but electric power properly applied through a G-E motor will save at many points. In manufacturing processes using electric power, this motor, Industry's Master Workman, is also a great power economizer.

A G-E motor can be applied to drive each of your machines at its maximum productive speed, even though this speed vary for each second of the machine's operation.

A G-E motor on each of your machines allows the best use of floor space, making every machine to which it is applied independent of lineshafting and belts.

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G-E notors can be connected to a curve drawing meter which will record when each machine is started or stopped as well as show the amount of power consumed at any moment. This graphic record forms an excellent means of discovering efficient employees.

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A Simple Twist Tightens Any Rope

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IF one of the bands on your multiple system rope drive stretch, a simple twist of the coupling tightens up any individual band and makes each rope do its share of the work.

No Resplicing Necessary

If interested in learning more about these couplings and Hunt Stevedore Rope with its unique system of lubrication that prevents wear and increases its efficiency, **ask for a copy of our Catalog S 12-8, "Manila Rope."** It contains 50 pages of information on rope drives for engineers.

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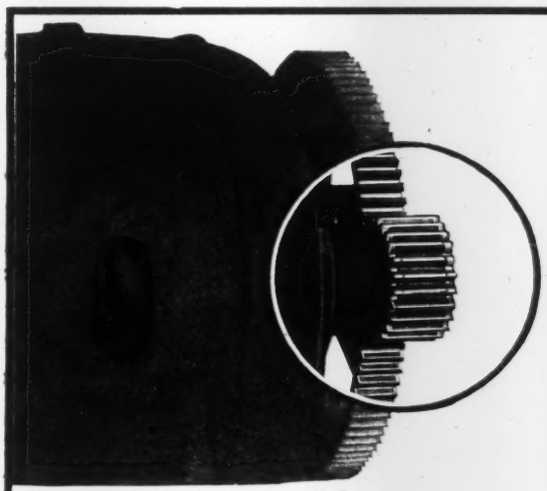

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New Process Noiseless Pinions

More and More

NOISELESS DURABLE
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Made for all kinds of high speed gear drives

NEW PROCESS IS TO ALL OTHER RAWHIDE AS STEEL IS TO IRON

NEW PROCESS GEAR CORPORATION

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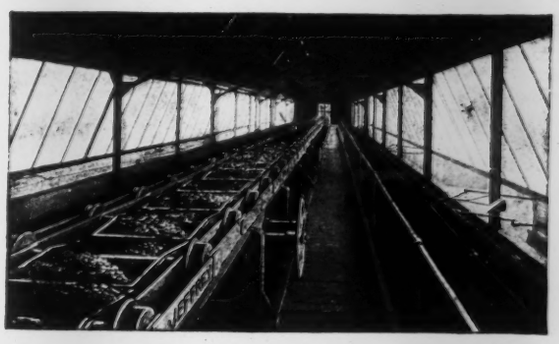

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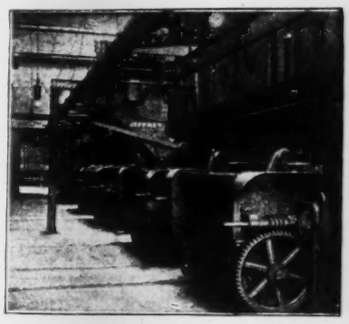
Jeffrey Coal and Ashes Handling Equipments

have earned a worldwide reputation for their simplicity, unfailing reliability and low operating and maintenance costs.

Jeffrey Pivoted Bucket Elevator-Conveyers are the Acme of equipments for large power plants.

Jeffrey Single Roll Crushers reduce any coal *uniformly* to size required for maximum stoker economy.

Jeffrey Automatic Weigh Hoppers automatically record every pound of coal fed to each boiler.



Traveling Weigh Hopper between Bin Storage and Stokers. Propelled by Hand Power, Electric Motor, or both.

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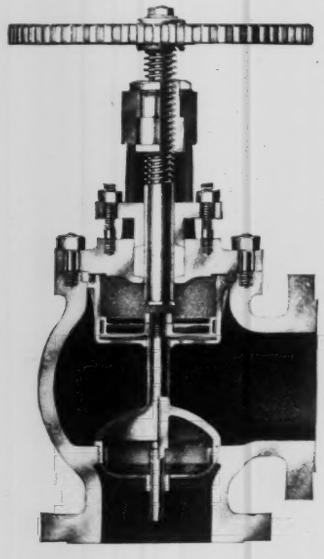
Automatic Equalizing Stop and Check Valves



These valves are designed to automatically shut off the flow of steam from the header to a boiler in case a tube should burst or other internal rupture occur. They also equalize the pressure between the different boilers in a battery, preventing one boiler from working at a lower pressure than another. As the valves can only be opened by the pressure in the boiler to which they are attached, it is impossible to accidentally turn steam into a boiler which is being cleaned.

The valves are cushioned, to prevent chattering, by an internal dashpot, made entirely of bronze—which eliminates the danger of sticking through corrosion. Care should be taken to install the valves in a vertical position only.

We are prepared to furnish these valves in Extra Heavy Iron Body Pattern, in sizes 4″ to 12″.

Each valve is carefully tested to 800 pounds hydraulic pressure and guaranteed for working steam pressures up to 250 pounds.

For *High Pressure Superheated Steam* up to 800° temperature, we make these valves with bodies and bonnets of Cast Steel having a tensile strength of 70,000 pounds, and other parts of metals which have been found to be best adapted for this kind of service.

All Genuine Jenkins Bros. Valves Have the Diamond Trade Mark— Your Protection

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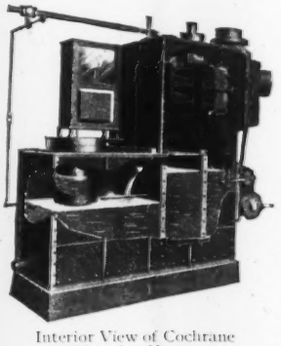
Our guarantee of "within 1½% of absolute accuracy by weight," which we make to all purchasers of Cochrane Metering Boiler Feed Water Heaters and Cochrane Independent Meters, is based on accurate knowledge obtained in the Cochrane Meter Testing Plant, shown above. We put up this plant in order to predetermine what Cochrane Meters would do under various and different conditions.

The accuracy of a

COCHRANE FEED WATER METER

is not affected by time or wear. There are no moving parts in contact with the flowing water, and parts, such as the weir, upon which scale or sludge may deposit from the water, are easily accessible for inspection and cleaning.



Interior View of Cochrane Metering Heater

If you are interested in this subject, send for our Engineering leaflet No. 16 on ***"Hot Water Meters and Their Practical Applications."***

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Schnicke Hydraulic
OPERATING VALVE

SCHNICKE VALVE

The Schnicke Hydraulic Operating Valve was designed expressly for use in Steel Mills and factories where machines and other apparatus are operated hydraulically. The valves are constructed so as to operate easily and be positive in their actions of opening and closing.

Owing to their design **it is impossible for these valves to stick while in service,** which feature is of extreme importance to the continuous operation of the apparatus which they control.

It is not an uncommon occurrence for valves of the leather cup and plunger type to "stick," which of course necessitates shutting down the machine or apparatus until the valve can be forced loose or overhauled.

Another feature of this valve is the absence of leather cups or other forms of packing rings in the internal working parts, which in most other valves are a source of continual trouble and expense.

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This **outside adjustment feature is not to be found in any other valve on the market,** and makes it possible for these Valves to remain in the most severe service from three to nine months without replacing ball or seat; while valves of the plunger type, working under similar conditions usually have to be repaired at least once or twice a week and not infrequently once or twice a day, owing to their leather cups or packing rings becoming worn or forced out of shape, causing them to leak or stick.

Schnicke hydraulic operating valves have been in service for three years in one of the most modern type mills in the United States, and have replaced leather cup valves throughout the mill which had been in service less than nine months, and have proven to be more reliable—less expensive to maintain—easier operated—and will wear longer in service than any other valve on the market.

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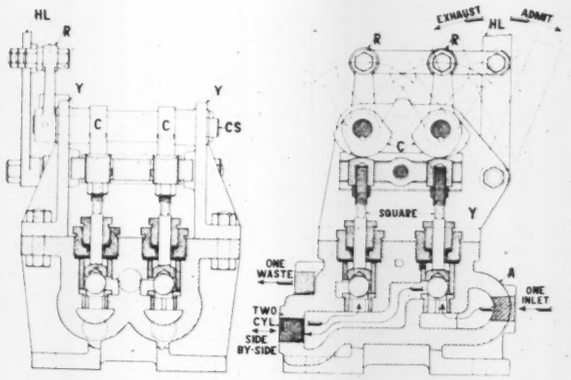

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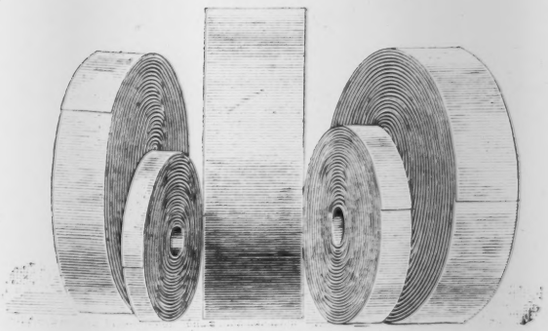
Strong Belting for MODERN MILLS



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For seventy years we have been making belting designed, not to please the man who asks "How cheap is it?" but to give lasting and truly economical service to the man who asks "How good is it?" We do not seek to please the man who wants a belt that is cheap in first cost, but the man who wants a belt that is cheap in service, in dependability, and in the capacity to transmit the maximum amount of obtainable power.

Cocheco Belting

is a centre stock, back-bone belt, originated more than sixty years ago, now enjoying a world-wide reputation as the standard of high quality belting. It contains no shoulder or spongy leather and is tanned by the long oak bark process—the best of all.

Shedite Belting

has all the enduring, superior qualities of COCHECO with the added quality of being steam proof and water proof. It gives perfect service under all conditions of dampness.

This is the selling policy that protects you: if the belting we send you is not as good as any—better than most, send it back at our expense.

If you want to get the full benefit of all the power generated in your power plant, and effect lasting economy in your belting expenses, send for catalog and prices.

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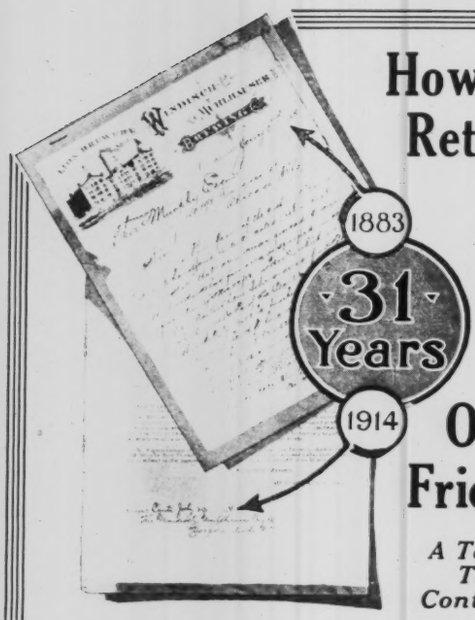

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A Tale of Two Contracts

IN evidence of the complete and permanent satisfaction obtained from an installation of

Murphy *Automatic* Furnaces

we reproduce the signature pages of two contract acceptances written thirty-one years apart—the latter covering a repeat order.

Let us tell you about this long established system of combustion. No obligations. Ask for Catalog "B."

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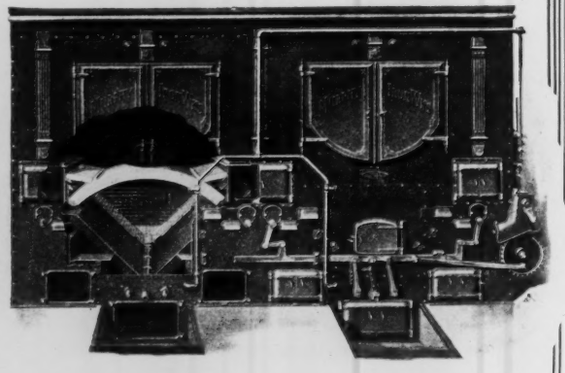
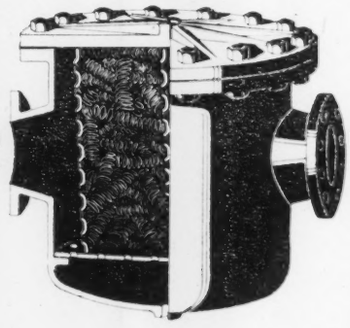


Improved Type OIL SEPARATOR



When used in conjunction with trap and oil filter, permits the use over and over of the oil now escaping with the exhaust. It will effect a still greater saving by keeping the heating surfaces of pipe coils, feed water heater, etc., entirely free from this oil, operates without back pressure on the engine and leaves the exhaust steam, when condensed, suitable for boiler feed or manufacturing purposes.

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Equip your Condensers with our

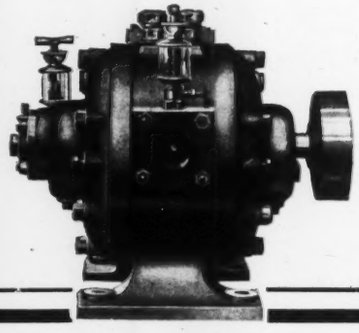
ROTARY AIR PUMP

Operates with nearly 100% volumetric efficiency—clearance is practically eliminated.

The rotary piston is absolutely tight fitting to the side walls, making internal leakage impossible.

There are no valves on the suction side. On the pressure side there are only small, light check valves.

These pumps can create a vacuum up to 0.3" mercury. They may also be used as air compressors up to 45 lbs.



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If you will send us a blue-print we will promptly quote on same. If you prefer, we shall be very glad to have one of our Mechanical Engineers call on you.

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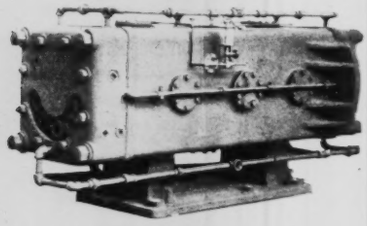
Are the Standard of Merit and have established notable records for Economy and Minimum Operating costs.



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HAMILTON UNIFLOW COMPRESSORS

are built for compressing gas and also air and are arranged for connecting to any type of Prime Mover. Design permits of large valve openings, both suction and discharge. Suction is taken through cylinder barrel, discharge through valves in head. Mechanical drive for valves is dispensed with entirely—no mechanism to get out of order. Cylinder heads permit large area for cooling, thereby increasing the Efficiency. No Pre-heating, no Pre-expansion and no reduction in volume by reason of wire-drawing when passing through suction valves is encountered in this type of compressor.

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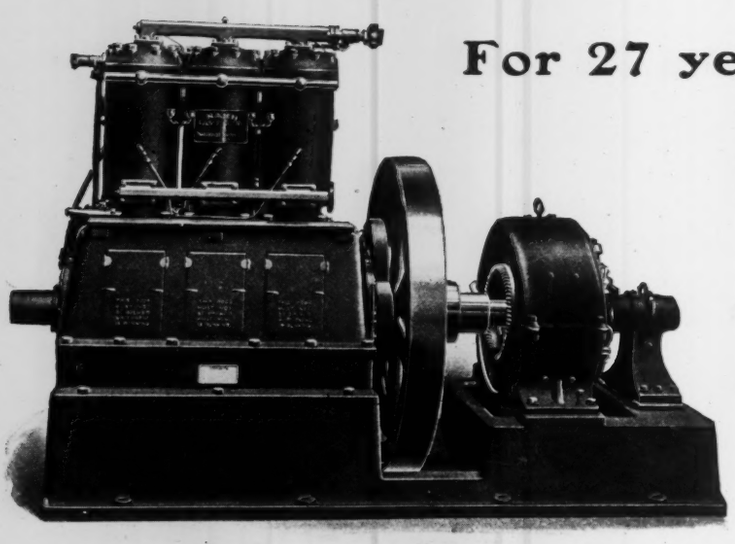

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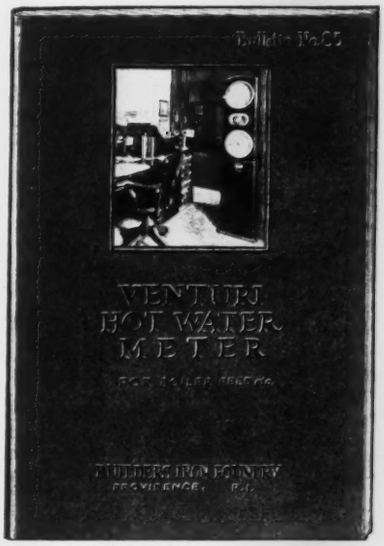
Our New Bulletin No. 85 M.—The Venturi Hot Water Meter

This 20 page pamphlet is a condensed but comprehensive work, giving a short history of the meter, an explanation of the principle involved, the different types of instruments, their methods of installation, and calibration tests; also a number of interesting cuts of well known plants, which use Venturi Meters.



Many improvements and additions which are the result of our engineering department's constant study are included in the bulletin. It is a reliable source of engineering information, and furthermore a book that will be a worthy addition to any library, for it is bound in a handsome, Brewster green, embossed cover and is printed in Century type on fine quality lustro-coated paper.

We will gladly mail it to you upon request.

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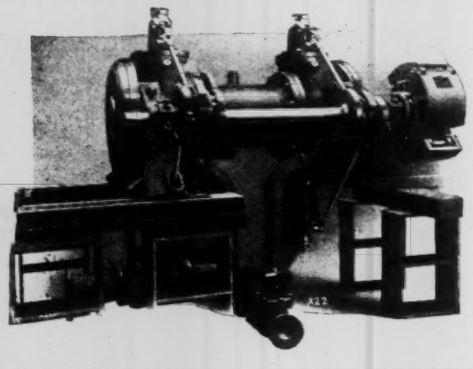
NORDBERG

POPPET VALVE ENGINES

THE cylinder and valve gear of the latest type of Nordberg high-speed Poppet Valve Engine is shown in the accompanying photograph. The cylinder is a cylindrical casting without steam or exhaust chest, separate steam and exhaust pipes being employed. The cylinder heads are cast separately from the cylinder and contain the valves, which are of the equilibrium type, with ground faces and seats. The valve cages are separate castings.

The valve gear is of a high speed design, positively operated from a revolving lay shaft, driven through bevel gears from the main shaft. An eccentric oscillates the cam which opens and closes the Poppet Valve positively without the use of springs. The governor is of the shaft type, and controls the cut-off.



Nordberg Poppet Valves are fitted to the ordinary (counter-flow) steam engines, to the Uniflow Engine, to blowing engines, air compressors and pumping engines. For information on Nordberg Poppet Valve Engines, send for Bulletin No. 25. Also ask for Bulletin No. 21, on Nordberg Uniflow Engines, a number of which, some with Corliss and some with Poppet Valves are now in service.

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Manufacturers of High Efficiency Corliss Engines; Uniflow Engines; Poppet Valve Engines; Air Compressors; Blowing Engines; Hoisting Engines; Pumping Engines; and other machinery.

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The Davis Reducing Valve

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This well designed, accurately made valve has a successful record of forty years back of it. It was the first good reducing valve made in this country and it is more in demand today than any other make.

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Having a perfectly balanced disk, the Davis Regulator is not affected by fluctuations in the high pressure. It will maintain a constant reduction to within a fraction of a pound, regardless of variations in the boiler pressure.

Get a Davis the next time you buy a reducing valve. It is fully guaranteed.

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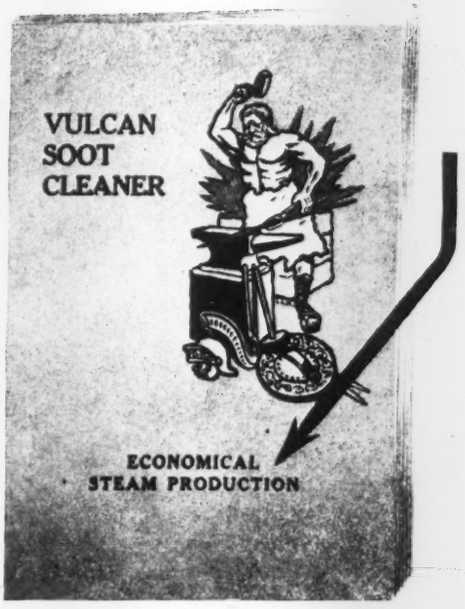

every man of you who has to do with the buying, installation or operation of steam-plant equipment

YOU NEED THIS FREE BOOK

It takes up in complete detail

the more economical production of steam the saving of coal the saving of labor the elimination of wear and tear on men the prevention of cold air entering boilers the securing of greater boiler capacity from the Elimination of Soot by the

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The booklet also contains valuable tables and the reports of many authoritative tests. Your copy will be sent on the next mail after we receive your name and address. Write today.

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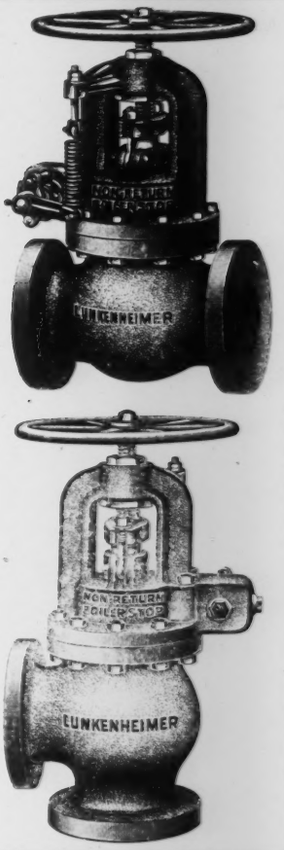
NON-RETURN SAFETY BOILER STOP VALVES



Prevent steam from other boilers of a battery discharging into one that is disabled. A sudden decrease in pressure in any boiler will cause a Lunkenheimer Non-return Safety Boiler Stop Valve attached to that boiler to immediately close, and will not open until the pressure equalizes that of the other boilers in the battery.

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Your local dealer can furnish them; if not, write us.

A complete description, with illustrations of the entire line, can be had by referring to Lunkenheimer Catalogue No. 50. Write for a copy.

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obtainable might be made into wire which would be too hard and brittle to make a good wire rope.

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The good rope, the kind which wears well and gives satisfactory service, is made from wire of uniform quality, stranded together in a workmanlike manner in accordance with designs, planned in the light of experience in manufacture and close study of the operation of wire rope in use.

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Such a reputation is not an accident but the natural result of a thorough appreciation of what must be done to make a good rope, and the necessary facilities for doing it.

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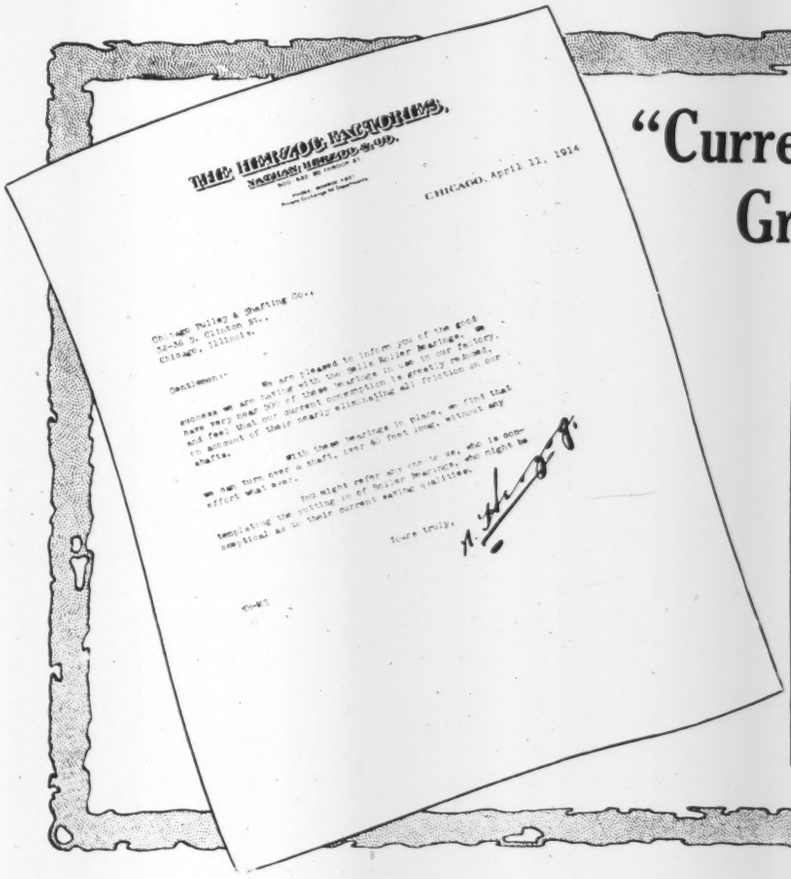
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CHICAGO, April 11, 1914

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We are pleased to inform you of the good success we are having with the Sells Roller Bearings. We have very near 90 of these machines in use on re-tors, and feel that our current consumption is greatly reduced, on account of their nearly eliminating all friction on our shafts.

With these bearings in place, we find that we can turn over a shaft, even 40 feet long, without any effort what ever.

You might refer any one to me, who is conversant as to their current saving qualities.

Yours truly,

"Current Consumption Greatly Reduced"

Doesn't this mean that "Sells" Roller Bearings have reduced the entire cost of manufacture? And doesn't this carry with it either a larger profit on the article or a lower selling price? In any event, it shows a way to cheaper production and distinct monetary savings.

"Sells" Roller Bearings

with *split* sleeves, *split* roller retainers and *split* boxes have made the same records as written in Mr. Herzog's letter, in the hundreds of plants in which they have been installed. Ask your machinery dealer or write us for full information. We'll be glad to send it along. Or why not write Mr. Herzog?

Power Transmission Machinery, Punches and Shears, Grinders, "Rollerine," the roller bearing lubricant.

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60 No. 5th St., Philadelphia, Pa.

Double Tramway at the Chattahooche Brick Co.

ANNOUNCEMENT

THE Ambursen Company announces that it has this day leased for a term of years the property and plant of the **CONSOLIDATED TRAMWAY COMPANY**, of Roanoke, Va., and will hereafter operate same under the sub-title of "Tramway Department." ¶ With its seasoned Engineering and Business organization the Ambursen Company will develop as a special field all that is implied in the term "Short-haul Transportation." Where the Railroad ends, Short-haul Transportation begins. ¶ Our special line of manufacture includes not only the well-known Lawson Automatic Tramway, but also the Lawson Flexible Conveyer, the Lawson Cable-Traction Railway System, etc., etc.

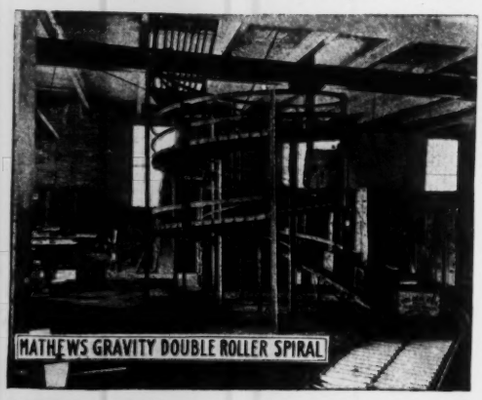
Very respectfully,

November 2, 1914 **AMBURSEN COMPANY, (Tramway Dept.) 61 Broadway, N. Y.**

Attention of Mechanical Engineers

Cut out this coupon, attach it to your letter head and we will mail our full set of catalogs and bulletins illustrating and describing the Mathews line of Standard Equipment, consisting of Gravity Conveyers, Automatic Elevators, Gravity Roller Spirals, Gravity Spiral Chutes, etc. Sooner or later you will have use for the information given in our literature.

THE **MATHEWS** STANDARD ORIGINAL LINE OF CONVEYERS



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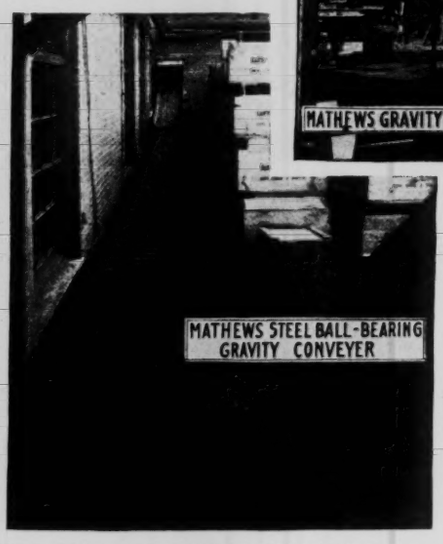
For All Handling Purposes Specify MATHEWS' CONVEYERS

THE OLDEST AND BEST-KNOWN LINE



Gravity Roller Conveyers,
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(Straight-lift and inclined)
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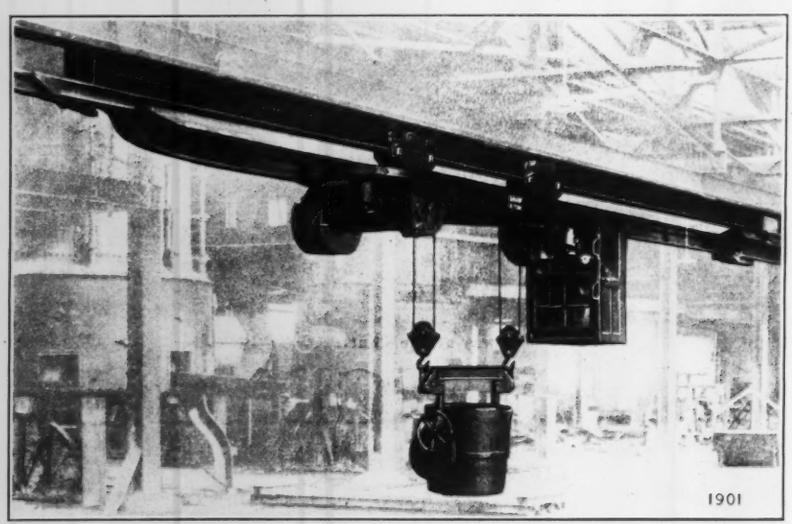

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20,000 H. P. TURBINE
Head 76 feet. Speed 120 R. P. M.
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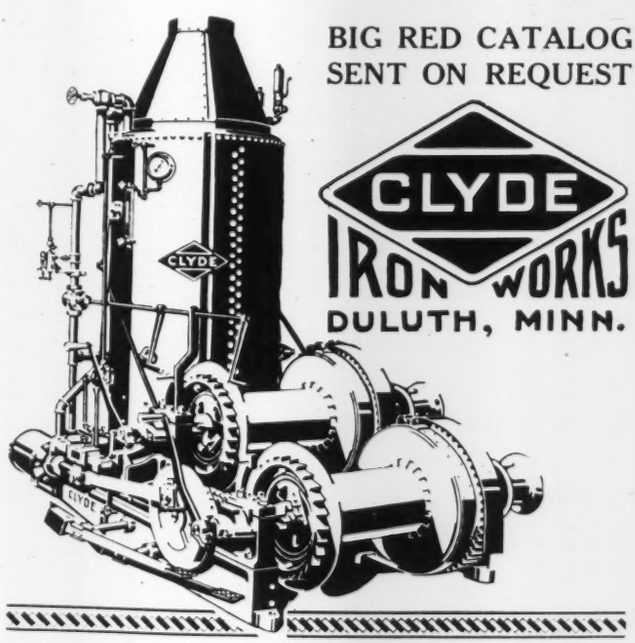
It's a *habit* with our hoists!



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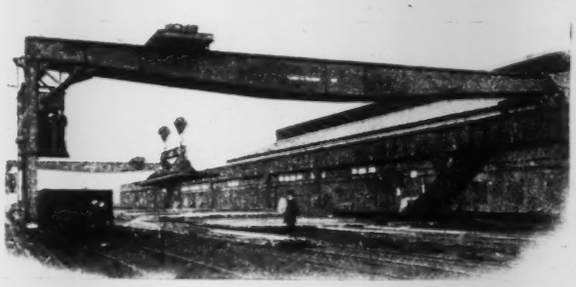

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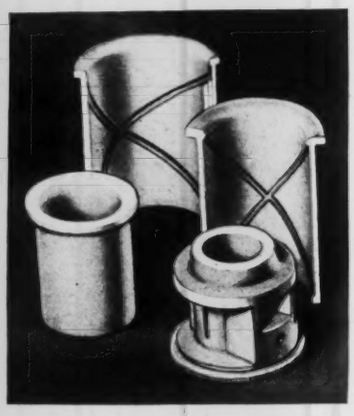

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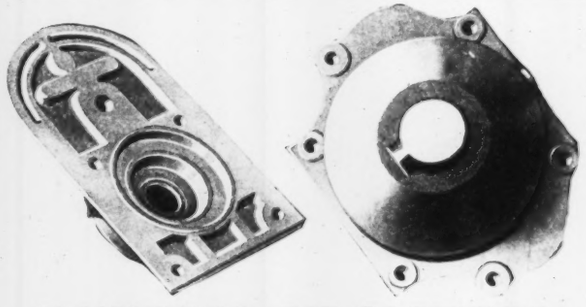

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Dimensions are accurate to within .001" to .005" according to size and design.

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The claims for this statement are based upon the following: Each cutter is an original gear.

Its tooth form is generated and does not depend upon formers or templates.

Being finished by grinding, all errors of hardening are eliminated.

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The mechanical processes of production are such that the limit of inspection is much lower than is possible of any other gear cutter.

Cutters of high speed are as accurate as of carbon steel.

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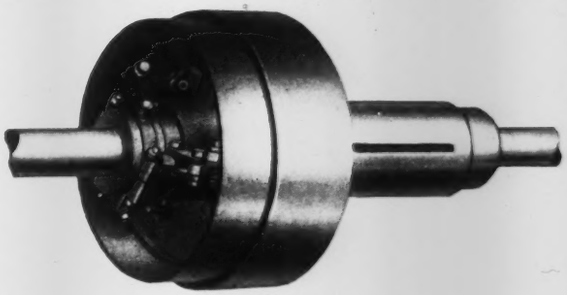

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MOORE & WHITE
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They're positive in action—reliable in *every* way—and will solve your client's clutch problems.

For 30 Years the Standard

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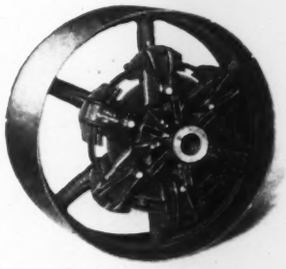

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Wherever there is a manufacturing process in which heat or time or pressure is a factor, the Tagliabue System of Automatic Control will save fuel, lighten labor costs, practically eliminate waste, improve the quality of the product, and absolutely guarantee its uniformity.

Tagliabue Controllers usually earn their cost in a few months, and they last a life-time.

If you will tell us what you make, we will give you not only the successful experience of other manufacturers, but complete details of the solution of your own temperature problems.

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In Very Small Indicating Instruments for Direct Current

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MODEL 280, Single Range Portable Voltmeter
(One-quarter Size.)

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(One-quarter Size.)

Miniature Precision Instruments

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Volt-Meters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters

are supplied in single, double and triple ranges, the Triple Range Volt-Ammeter comprising six instruments in one. This group also includes BATTERY TESTERS.

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This new line of instruments represents the finest development of small size pivoted moving coil, permanent magnet type of instruments.
They embody characteristics which have made the well-known Weston Standard famous throughout the world. They are accurate, dead beat and extremely sensitive.
They may be left continuously in circuit at full load and are shielded against external electrical and magnetic influences.
They are substantially constructed and have the longest scale ever provided in instruments of similar size.
The prices are surprisingly low for instruments of such quality.
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Weston Electrical Instrument Co., Newark, N. J.

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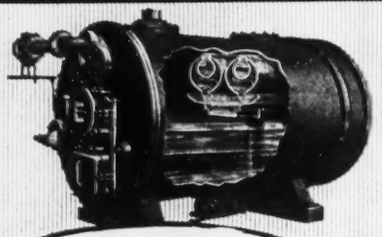

Direct Contact FEED WATER HEATERS Cut the High Cost of Boiling

The exhaust steam condensed becomes one-seventh of the feed water going to the boilers. One-seventh of the water bill is saved, as well as about twelve per cent. of the fuel. ¶ The unique features of the contact pipes, the evident advantages of upward filtration, and other details of the National are explained in Catalog No. 2—send for it.

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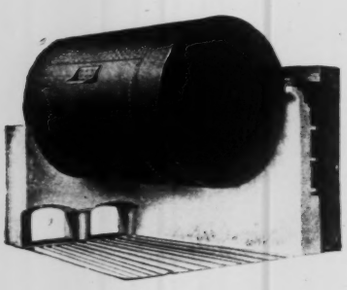

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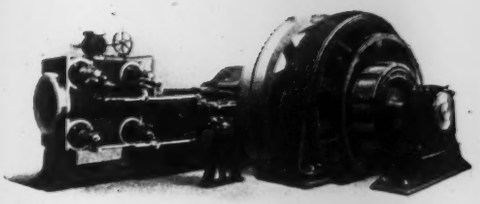

If you have thoughts of buying an engine, there are three questions that should be thoroughly answered:

Do I need an engine? Has the engine I think of buying the actual money value asked for it? Has it a reputation that will bear the criticism of the Engineer who knows?

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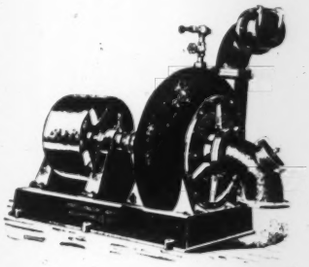

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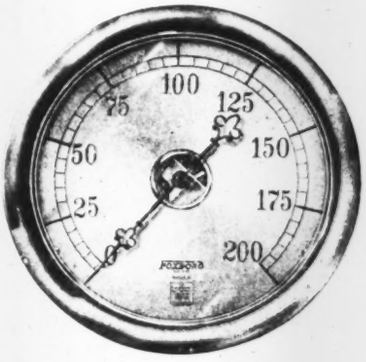

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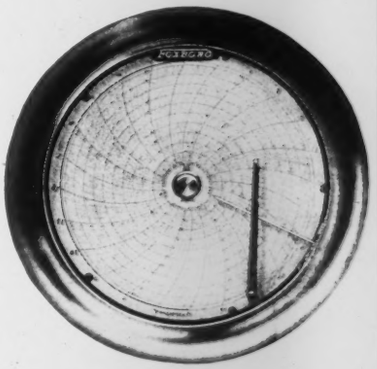

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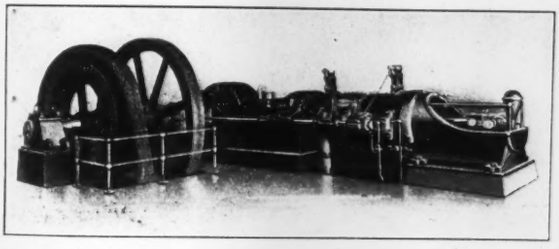

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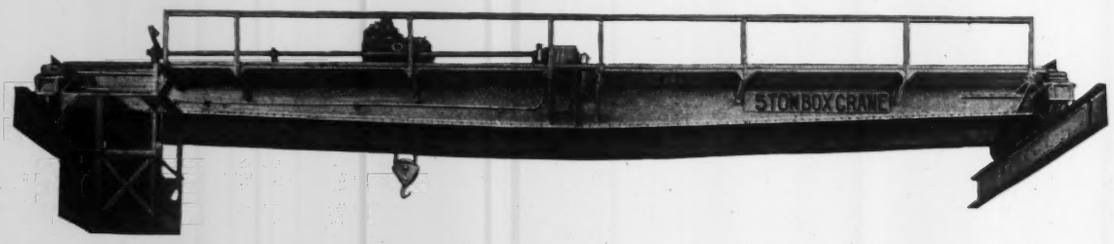

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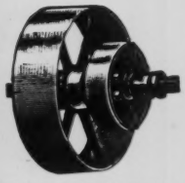

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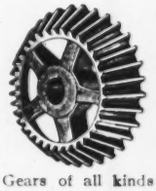

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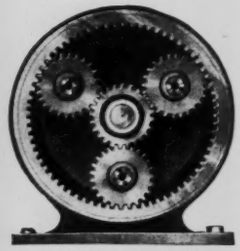
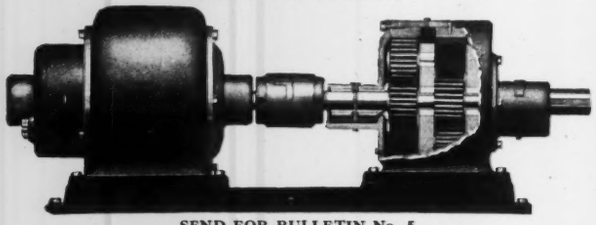
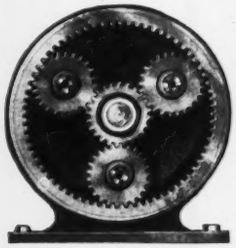


O. K. Speed Reducing Transmissions meet the demands for a reliable and efficient method for reducing the motor speed without the use of belts or chains.





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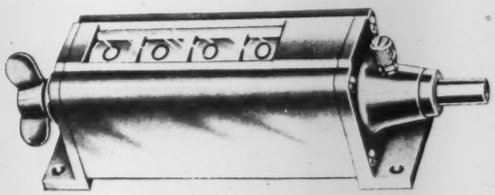

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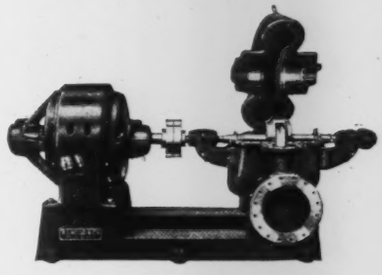
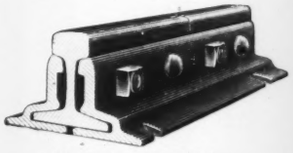
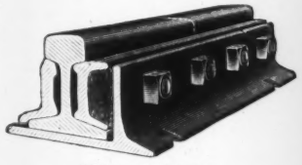




Continuous Rail Joint



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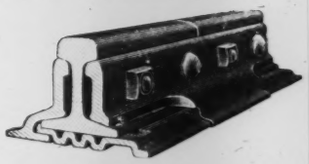

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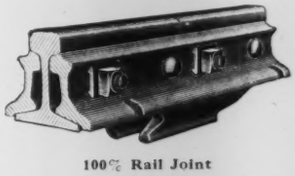

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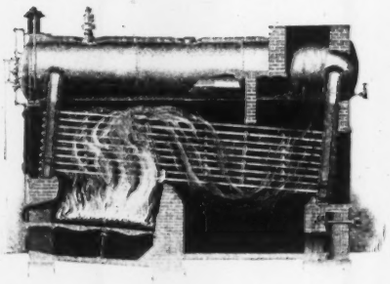

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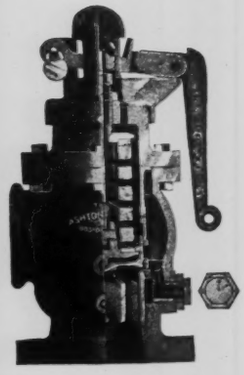

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THE BROWN HOISTING MACHINERY CO.

CLEVELAND, O., U. S. A.
NEW YORK SAN FRANCISCO
PITTSBURGH CHICAGO MONTREAL

Designers and Manufacturers of all kinds of Hoisting Machinery, including Locomotive Cranes, Electric Travelers, I-beam Trolleys, Crabs, Winches, etc., as well as heavy Hoisting Machinery of all descriptions. Also Ferroinclave for reinforced concrete roofing.

See page 201 *of Condensed Catalogues of Mechanical Equipment*, 1913 *Volume.*

Hoisting Machinery

H. W. CALDWELL & SON COMPANY

NEW YORK CHICAGO

Elevating, Conveying and Power Transmitting Machinery. Helicoid and screw conveyors, machine molded gears, pulleys, fly-wheels, rope sheaves and drives, sprocket wheels and chain, buckets, belting, shafting and bearings.

See page 187 *of Condensed Catalogues of Mechanical Equipment*, 1913 *Volume.*

Conveyors
Elevators
Power Transmission

DODGE MANUFACTURING COMPANY

MISHAWAKA, IND.

Everything for the Mechanical Transmission of Power, Elevating and Conveying; and Water Softeners. Write for "Power Transmission Engineering," the most complete book of its kind published. It will help you in your specifications.

Transmission Machinery
Water Softeners
Rope Drives
Conveyors

THE EASTERN MACHINERY COMPANY

NEW HAVEN, CONN.

Manufacturers of Electric and Belt Power Passenger and Freight Elevators, Hoisting Machines, Friction Winding Drums, Friction Clutches and Friction Clutch Pulleys.

Elevators
Friction Clutches
Pulleys

THE FAFNIR BEARING COMPANY

NEW BRITAIN, CONN.

High grade Ball Bearings made of the finest materials to the closest standards of accuracy in the world. Fafnir Ball Bearing Hanger Boxes can be used in any standard hanger frame.

Ball Bearings

THE HILL CLUTCH COMPANY

CLEVELAND, OHIO

Manufacturers of a complete line of Power Transmission Machinery for belt, rope or gear driving, including the well known Hill Friction Clutches and Hill Collar Oiling Bearings.

See page 156 *of Condensed Catalogues of Mechanical Equipment*, 1913 *Volume.*

Power Transmission

LIDGERWOOD MFG. CO.

96 LIBERTY ST. NEW YORK

Hoisting Engines—steam and electric, for every use of the contractor, miner, warehouseman, railroads, shipowners, etc. Derricks, Derrick Irons and Derrick Hoists, Cableways for hoisting and conveying, Marine Transfer for coal and cargo handling.

Hoisting Engines
Cableways
Marine Transfers

LINK-BELT COMPANY

PHILADELPHIA CHICAGO
INDIANAPOLIS

Elevators and Conveyors for every purpose; all accessories; Power Transmission Machinery. The Link-Belt Silent Chain Drive, Coal Tipples, Coal Washeries, Locomotive Cranes, etc.

See page 192 *of Condensed Catalogues of Mechanical Equipment*, 1913 *Volume.*

Elevators and Conveyors

Cranes

THE MORGAN ENGINEERING CO. ALLIANCE, OHIO

Are the largest builders of Electric Traveling Cranes in the world. We also design and build Steel Plants complete, Hammers, Presses, Shears, Charging Machines and all kinds of Rolling Mill and Special Machinery.

Robins Belt Conveyors

ROBINS CONVEYING BELT COMPANY 13 PARK ROW NEW YORK

The Robins Belt Conveyor was the original and is today the standard of this type of conveying machinery. It is successfully and economically conveying ore, rock, coal and similar materials under the most trying conditions of service. Correspondence invited.

See page 193 *of Condensed Catalogues of Mechanical Equipment*, 1913 *Volume.*

Pulleys

Paper Friction Transmission

THE ROCKWOOD MANUFACTURING CO. 1923 ENGLISH AVE. INDIANAPOLIS, IND.

Rockwood Paper Frictions have proven their unquestioned superiority. You will find our booklets regarding Transmission of Power by Belts and Friction Transmission desirable additions to your engineering library. Furnished free to members upon application.

Cranes

Mono-Rail Systems

SHAW ELECTRIC CRANE CO. MUSKEGON, MICH.

Address 119 W. 40th St., New York, (*See Manning, Maxwell & Moore, Inc.*)

Electric traveling Cranes for all purposes. Gantry Cranes. Wharf Cranes and Winches. Mono-Rail Systems.

Cranes

Hoists

THE TOLEDO BRIDGE & CRANE CO. TOLEDO, OHIO

Toledo Cranes and Hoists; Coal and Ore Handling Bridges; Grab Bucket Machinery; Electric and Hand Power Cranes, all types, any capacity; Structural Steel for Factory Buildings.

Elevating

Conveying

Power Transmitting Machinery

THE WEBSTER M'F'G COMPANY (Successors to WEBSTER M'F'G CO.) TIFFIN, OHIO
EASTERN BRANCH: 88-90 READE ST. NEW YORK

Manufacturers of Elevating, Conveying and Power Transmitting Machinery for all purposes. Over thirty years' experience in this line and extensive facilities for manufacturing give us large advantages. Belt Conveyors for handling cements, ores, sand, gravel, etc. Coal and Ash Handling Systems for power plants and buildings. Chain belting. Gearing.

Power Transmission

T. B. WOOD'S SONS CO. CHAMBERSBURG, PA.

Modern and Approved Appliances for the transmission of Power. Shafting, Couplings, Collars, Hangers, Pulleys, Belt Tighteners, Friction Clutches, Rope Driving Equipments.

See pages 154, 155 *of Condensed Catalogues of Mechanical Equipment*, 1913 *Volume.*

STEEL WORKS AND ROLLING MILL EQUIPMENT

Engines

Rolling Mill Machinery

MACKINTOSH, HEMPHILL & CO. PITTSBURGH, PA.

Engines, single and compound, Corliss reversing and blowing. Rolling Mill and Hydraulic Machinery of all kinds. Shears, Punches, Saws, Coping Machines.

Blast Furnace Blowing Engines

WEIMER MACHINE WORKS COMPANY LEBANON, PA.

Builders of Blast Furnace Blowing engines and equipments. Cinder and hot metal cars. Furnace Bells and Hoppers. Rolling Mill castings. Special attention paid to quick repair work and work governed by Engineers' specifications.

MACHINE SHOP AND FOUNDRY EQUIPMENT

THE HEALD MACHINE COMPANY

WORCESTER, MASS

Manufacturers of Grinding Machines. Internal Grinders, Cylinder Grinders, Surface Grinders, Drill Grinders.

Grinding Machines

THE KING MACHINE TOOL CO.

CINCINNATI, O.

Vertical Turret Machines, 28" and 34". Vertical Boring and Turning Machines, 42" to 84" inclusive.

Heavy Duty Boring Mills

THE R. K. LE BLOND MACHINE TOOL CO.

CINCINNATI, O.

We manufacture a complete line of Heavy Duty Lathes and Milling Machines. They are scientifically designed, so the power is limited only by the strength of the cutting tool. It will pay you to investigate our machines. Catalogue upon request.

Lathes

Milling Machines

MUMFORD MOLDING MACHINE CO.

2075 Elston Ave. CHICAGO, ILL.

Squeezing Machines, Hand or Power
Jolt Ramming Machines, Pneumatic or Electric
Split Pattern Vibrator Machines
Pneumatic Vibrators

See page 216 of Condensed Catalogues of Mechanical Equipment, 1913 Volume.

Foundry Molding Machine Equipment

WELLS BROTHERS COMPANY

GREENFIELD, MASS.

We make and sell the Little Giant line of Taps, Dies, Screw Cutting Tools and Machinery.

Taps and Dies

BLOWERS, FANS, DRYERS, ETC.

P. H. & F. M. ROOTS CO.

CONNERSVILLE, IND.

Positive Pressure Blowers for foundries. High Pressure Blowers. Blowers for vacuum cleaning, for laundries, for blacksmiths. Positive Rotary Pumps. Positive Pressure Gas Exhausters. High Pressure Gas Pumps. Flexible Couplings.

See pages 282, 283 of Condensed Catalogues of Mechanical Equipment, 1913 Volume.

Blowers

Gas Exhausters

Pumps

RUGGLES-COLES ENGINEERING CO.

McCormick Bldg. CHICAGO
Hudson Terminal NEW YORK

Dryers. Direct heat, Indirect heat, and Steam Dryers for all kinds of materials.

See page 301 of Condensed Catalogues of Mechanical Equipment, 1913 Volume.

Dryers

B. F. STURTEVANT COMPANY

HYDE PARK, MASS.

We make equipment to force or exhaust air under all conditions. Largest standard line of "ready to deliver" Fans in the world and special work done where necessary. Consulting representatives in or near your city.

See pages 48, 49 of Condensed Catalogues of Mechanical Equipment, 1913 Volume.

Fans

Blowers

Economizers

Engines

PUMPS AND HYDRAULIC TURBINES

Pumps
Condensers

M. T. DAVIDSON CO.

43-53 Keap St. BROOKLYN, N. Y.
New York: 154 Nassau St.
Boston: 30 Oliver St.

High grade economical Pumps for all services. Surface and Jet Condensers.

Water Wheels
Wood Pulp and Paper Machinery

HOLYOKE MACHINE COMPANY

HOLYOKE, MASS.
WORCESTER, MASS.

Water Wheels with Connections and Complete Power Transmission, Water Wheel Governors, Gearing, Wood Pulp and Paper Machinery, Pumps, Hydraulic Presses. Special Machinery to order.

Turbines
Paper Mill Machinery

J. & W. JOLLY, Inc.

HOLYOKE, MASS.

McCormick Holyoke Turbines designed to suit Mill or Hydro-Electric Work. Paper Mill Machinery, Shafting, Gearing, Pulleys and Freight Elevators.

See page 298 of Condensed Catalogues of Mechanical Equipment, 1913 Volume.

Vacuum Pumps

LAMMERT & MANN

215-221 N. Wood St. CHICAGO, ILL.

Engineers and Machinists.
Manufacturers of Rotary Vacuum Pumps for highest dry vacuum, Lead Pumps, Rotary Blowers, etc.

ELECTRICAL APPARATUS, ENGINEERING MISCELLANY

Aluminum

ALUMINUM COMPANY OF AMERICA

PITTSBURGH, PA.

Aluminum Ingot, Sheet, Rod, Wire, Cable, Tubing and other forms.

See page 267 of Condensed Catalogues of Mechanical Equipment, 1913 Volume.

Water Purifying Machinery

ELECTRIC WATER STERILIZER CO.

SCOTTDALE, PA.

Manufacturers of Electrical and Mechanical Water Purifying Machinery. Our Electric Water Sterilizing Machine is both economical in consumption of electric current and so simple that any one of average intelligence can take care of it. Guaranteed to deliver pure water. Capacities of stock machines from 40 to 1000 gallons per hour.

Bright Cold Finished Steel Bars

UNION DRAWN STEEL CO.

BEAVER FALLS, PA.

Makers of Bright Cold Finished Bessemer, Open Hearth Crucible and Alloy Steels, in Rounds, Flats, Squares, Hexagons and Special Shapes.

See page 263 of Condensed Catalogues of Mechanical Equipment, 1913 Volume.

Dynamos
Motors
Transformers
Instruments

WAGNER ELECTRIC MANUFACTURING COMPANY

ST. LOUIS, MO.

Single-Phase Motors. Polyphase Motors. Transformers, Power and Pole Type. Instruments, a complete line. A. C. Generators. Converters for charging vehicle batteries from A. C. Rectifiers for charging small storage batteries from A. C. Train Lighting (Electric) Equipments. Automobile Self Starters (Electric), etc.

CLASSIFIED LIST OF MECHANICAL EQUIPMENT

Manufactured by Firms Represented in The Journal of The American Society of Mechanical Engineers

Accumulators, Hydraulic
* Alliance Machine Co.
Mackintosh, Hemphill & Co.
Mesta Machine Co.
Morgan Engineering Co.
* Wood & Co., R. D.

Aerial Tramways
(See Tramways, Wire Rope)

Air Brakes, Compressors, Filters, Receivers, etc.
(See Brakes, Compressors, Filters, Receivers, etc., Air)

Air-Jet Lifts
Schutte & Koerting Co.

Air Lift Pumping Systems
* Ingersoll-Rand Co.

Air Washers
General Condenser Co.
* Sturtevant Co., B. F.

Alloys
* Aluminum Co. of America

Alternators
(See Generators, Electric)

Aluminum, Ingot
* Aluminum Co. of America

Aluminum, Sheet
* Aluminum Co. of America

Ammeters, Voltmeters
(See Electrical Instruments)

Ammonia Condensers, Fittings, etc.
(See Condensers, Fittings, etc., Ammonia)

Anvil Blocks
* Hooven, Owens, Rentschler Co.

Arc Lamps
(See Lamps, Arc)

Arches, Ignition (Flat Suspended)
Green Engineering Co.

Asbestos Products
* Keasbey Co., Robt. A.

Ash Ejectors
(See Ejectors, Ash)

Augers, Power Coal
Fairmont Mining Mach. Co.

Balanced Main Valves
(See Valves, Balanced Distribution)

Barometers
* Tagliabue Mfg. Co., C. J.

Ball Bearings
(See Bearings, Ball)

Balls, Brass and Bronze
* Auburn Ball Bearing Co.

Balls, Steel
* Auburn Ball Bearing Co.

Barrels, Tumbling
Royersford Foundry & Machine Co.

Barrows, Furnace Charging
Weimer Machine Works Co.

Bearings, Ball
* Auburn Ball Bearing Co.
Fafnir Bearing Co.

Bearings, Roller
Royersford Foundry & Machine Co.

Bearings, Self-Oiling
* Brown Co., A. & F.
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
Doehler Die-Casting Co.
* Falls Clutch & Machinery Co.
Franklin Manufacturing Co.
* Hill Clutch Co.
Jeffrey Manufacturing Co.
Royersford Foundry & Machine Co.
Webster Mfg. Co.
Wood's Sons Co., T. B.

Bearings, Thrust
* Auburn Ball Bearing Co.
Fafnir Bearing Co.
* Hill Clutch Co.

Bells and Hoppers, Furnace
Weimer Machine Works Co.

Belt Dressing
Schieren Co., Chas. A.
* Texas Co.

Belt Lacing
Schieren Co., Chas. A.
Williams & Sons, I. B.

Belt Lacing, Steel
Bristol Co.

Belt Tighteners
* Brown Co., A. & F.
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
* Hill Clutch Co.
Webster Mfg. Co.
Wood's Sons Co., T. B.

Belting, Chain
(See Chains and Chain Links)

Belting, Conveyor
* Goodrich Co., B. F.
Manhattan Rubber Mfg. Co.
* Robins Conveying Belt Co.

Belting, Rubber
* Goodrich Co., B. F.
Manhattan Rubber Mfg. Co.

Belting, Leather
Schieren Co., Chas. A.
Williams & Sons, I. B.

Belting, Textile
* Goodrich Co., B. F.

Bending Machines, Hydraulic
Morgan Engineering Co.
* Wood & Co., R. D.

Bins, Suspended
* Brown Hoisting Machinery Co.

Blocks, Tackle
* Clyde Iron Works
* Hunt Co., Inc., C. W.
* Roebling's Sons Co., John A.

Blowers, Centrifugal
* General Electric Co.

Blowers, Fan
Green Fuel Economizer Co.
* Sturtevant Co., B. F.

Blowers, Pressure
Lammert & Mann
* Roots Co., P. H. & F. M.
* Sturtevant Co., B. F.

Blowers, Rotary
Lammert & Mann
* Roots Co., P. H. & F. M.
Schutte & Koerting Co.

Blowers, Soot
Simonds & Co., G. L.

Blowers, Steam
Schutte & Koerting Co.

Boiler Coverings, Furnaces, Tube Cleaners, Tubes, etc.
(See Coverings, Furnaces, Tube Cleaners, Tubes, etc., Boiler)

Boilers, Heating
* Keeler Co., E.
* Smith Co., H. B.

Boilers, Locomotive
* Clyde Iron Works
Erie City Iron Works
Lidgerwood Mfg. Co.

Boilers, Marine
* Almy Water Tube Boiler Co.
Babcock & Wilcox Co.
* Keeler Co., E.

Boilers, Range (Galvanized
Scaife & Sons Co., Wm. B.

Boilers, Tubular
* Clyde Iron Works
Erie City Iron Works
* Keeler Co., E.
Lidgerwood Mfg. Co.

Boilers, Water Tube
* Almy Water Tube Boiler Co.
Babcock & Wilcox Co.
* Edge Moor Iron Co.
Erie City Iron Works
Heine Safety Boiler Co.
* Keeler Co., E.

Bolt-Cutting Machines
Wells Bros. Co.

Boring and Drilling Machines
Manning, Maxwell & Moore, Inc.

Boring and Turning Mills, Vertical
King Machine Tool Co.

Brass-Working Machine Tools
(See Tools, Brass-working Machine)

Brewers' and Bottlers' Machinery
* Vilter Mfg. Co.

Brick, Fire
* Betson Plastic Fire Brick Co.

Bridge Tramways
(See Tramways, Bridge)

Bridges
Toledo Bridge & Crane Co.

Buckets, Elevator
* Caldwell & Son Co., H. W.
Jeffrey Manufacturing Co.
* Link-Belt Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Buckets, Grab
* Brown Hoisting Machinery Co.
* Clyde Iron Works
* Hunt Co., Inc., C. W.
Jeffrey Manufacturing Co.
* Link-Belt Co.
Orton & Steinbrenner Co.
* Robins Conveying Belt Co.

Buckets, Self-Dumping
* Brown Hoisting Machinery Co.
* Clyde Iron Works
* Hunt Co., Inc., C. W.
Orton & Steinbrenner Co.

Bulldozers
* Wood & Co., R. D.

Burners, Gas
Weimer Machine Works Co.

Burners, Oil
Best, W. N.
Schutte & Koerting Co.

Cable, Wire
(See Rope, Wire)

Cable Railways
(See Railways, Cable)

Cableways, Wire
(See Tramways, Wire Rope)

Cables, Electrical
(See Wire and Cables, Electrical)

Calenders, Roll
Farrel Foundry & Machine Co.

Calorimeters
* American Steam Gauge & Valve Mfg. Co.

Cam Cutting Machines.
Garvin Machine Co.

Car Hauls, Cable and Chain
Fairmont Mining Mach. Co.
Jeffrey Mfg. Co.

Carriers and Elevators, Freight, Continuous
Jeffrey Manufacturing Co.
* Link-Belt Co.
Mathews Gravity Carrier Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Cars, Cinder and Hot Metal
Weimer Machine Works Co.

Cars, Dump
* Hunt Co., Inc., C. W.
Weimer Machine Works Co.

Cars, Freight Elevator
Eastern Machinery Co.

Cars, Industrial Railway
* Hunt Co., Inc., C. W.
* Link-Belt Co.

Cars, Motor
* Hunt Co., Inc., C. W.

Castings, Aluminum
* Aluminum Co. of America

Castings, Brass and Bronze
Crescent Mfg. Co.
* Homestead Valve Mfg. Co.

Castings, Die-Molded
Doehler Die-Casting Co.
Franklin Manufacturing Co.
* Veeder Mfg. Co.

Castings, Iron
* Brown Co., A. & F.
Builders Iron Foundry.
* Caldwell & Son Co., H. W.
* Falls Clutch & Machinery Co.
Fairmont Mining Mach. Co.
Harrisburg Foundry & Machine Works
* Hill Clutch Co.
Holyoke Machine Co.
* Homestead Valve Mfg. Co.
* Hooven, Owens, Rentschler Co.
* Lunkenheimer Co.
Mesta Machine Co.
* Robins Conveying Belt Co.
Royersford Foundry & Machine Co.
Weimer Machine Works Co.
* Wheeler Condenser & Engineering Co.
* Wood & Co., R. D.

Castings, Semi-Steel
Builders Iron Foundry
* Caldwell & Son Co., H. W.
Fairmont Mining Mach. Co.
* Hill Clutch Co.
* Hooven, Owens, Rentschler Co.
* Lunkenheimer Co.
* Wood & Co., R. D.

Castings, Steel
Mackintosh, Hemphill & Co.
Mesta Machine Co.

Celluloid and Linoleum Machinery
Farrel Foundry & Machine Co.

Cement, Belt
Schieren Co., Chas. A.

Cement, Fire Brick
* Betson Plastic Fire Brick Co.

Cement Machinery
* Hill Clutch Co.

Centrifugal Pumps
(See Pumps, Centrifugal)

Chain Drives
* Link-Belt Co.

Chain Grate Stokers
(See Stokers, Chain Grate)

Chains and Chain Links
* Caldwell & Son Co., H. W.
Jeffrey Manufacturing Co.
* Link-Belt Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Channeling Machines, Mine and Quarry
* Ingersoll-Rand Co.

Charging Machines, Furnace
* Alliance Machine Co.
Morgan Engineering Co.

Chimneys, Steel
(See Stacks, Steel)

Chucking Machines
Garvin Machine Co.
* Jones & Lamson Machine Co.
Le Blond Machine Tool Co., R. K.
* Warner & Swasey Co.

Chutes
Fairmont Mining Mach. Co.
* Hunt Co., Inc., C. W.
Jeffrey Mfg. Co.
* Link-Belt Co.

Chutes, Gravity Spiral
Mathews Gravity Carrier Co.

Circulators, Feed Water
Schutte & Koerting Co.

Circulators, Steam Heating
Schutte & Koerting Co.

Clamps, Pipe-Joint
Yarnall-Waring Co.

Clamps, Wire Rope
(See Wire Rope Fastenings)

Clutch Leathers
(See Leathers, Automobile)

Clutches, Friction
* Brown Co., A. & F.
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
Eastern Machinery Co.
* Falls Clutch & Machinery Co.
Farrel Foundry & Machine Co.
* Hill Clutch Co.
Holyoke Machine Co.
Jeffrey Mfg. Co.
* Link-Belt Co.
* Moore & White Co.
Webster Mfg. Co.
Wood's Sons Co., T. B.

*Catalogue data of firms marked * appear in the A. S. M. E. Condensed Catalogues of Mechanical Equipment, 1914 Volume.*

Coal and Ash Handling Machinery
* Brown Hoisting Machinery Co.
* Caldwell & Son Co., H. W.
Fairmont Mining Mach. Co.
* Green Engineering Co.
* Hunt Co., Inc., C. W.
Jeffrey Mfg. Co.
* Link-Belt Co.
Orton & Steinbrenner Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Coal Crushers
* Hunt Co., Inc., C. W.
Jeffrey Mfg. Co.
* Link-Belt Co.
Orton & Steinbrenner Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Coal Mine Equipments and Supplies
Fairmont Mining Mach. Co.
Jeffrey Mfg. Co.

Coal Mining Machinery
* Ingersoll-Rand Co.
Jeffrey Mfg. Co.

Coaling Stations, Locomotive
* Brown Hoisting Machinery Co.
* Hunt Co., Inc., C. W.
* Link-Belt Co.
Webster Mfg. Co.

Cocks, Air and Gage
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.
* Jenkins Bros.
* Lunkenheimer Co.
* Pratt & Cady Co., Inc.
Walworth Mfg. Co.

Cocks, Blowoff
* Homestead Valve Mfg. Co.
* Lunkenheimer Co.
* Pratt & Cady Co., Inc.
Walworth Mfg. Co.

Cocks, Three-way and Four-way
* American Steam Gauge & Valve Mfg. Co.
* Homestead Valve Mfg. Co.
* Lunkenheimer Co.
* Pratt & Cady Co., Inc.
Walworth Mfg. Co.

Coils, Pipe
National Pipe Bending Co.
* Vilter Mfg. Co.

Coke Oven Machinery
* Alliance Machine Co.
* Brown Hoisting Machinery Co.

Cold Storage Insulation
* Keasbey Co., Robt. A.

Cold Storage Plants
* De La Vergne Machine Co.

Collars, Shafting
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
* Hill Clutch Co.
Royersford Foundry & Machine Co.
Wood's Sons Co., T. B.

Collectors, Dust
* Sturtevant Co., B. F.

Combustion Recorders
Simonds & Co., G. L.

Compressors, Air
* Devine Co., J. P.
* General Electric Co.
* Goulds Manufacturing Co.
* Hooven, Owens, Rentschler Co.
* Ingersoll-Rand Co.
Mackintosh, Hemphill & Co.
Mesta Machine Co.
* Nordberg Mfg. Co.
* Roots Co., P. H. & F. M.

Compressors, Air, Compound
* Ingersoll-Rand Co.
* Nordberg Mfg. Co.

Compressors, Ammonia
* Vilter Mfg. Co.

Compressors, Gas
* Hooven, Owens, Rentschler Co.
* Ingersoll-Rand Co.
Mesta Machine Co.
* Nordberg Mfg. Co.
* Roots Co., P. H. & F. M.

Concrete Reinforcement
* Brown Hoisting Machinery Co.

Condensation Pumps with Automatic Receivers
(See Pumps, Condensation, with Automatic Receivers)

Condensers
Davidson Co., M. T.
* Devine Co., J. P.
* Nordberg Mfg. Co.
* Wheeler Condenser & Engineering Co.

Condensers, Ammonia
De La Vergne Machine Co.
* Vilter Mfg. Co.

Condensers, Barometric
Mesta Machine Co.
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Condensers, Jet
Davidson Co., M. T.
General Condenser Co.
Schutte & Koerting Co.
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Condensers, Surface
Davidson Co., M. T.
General Condenser Co.
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Controllers, Automatic, for Temperature or for Pressure
(See Regulators)

Controllers, Electric
* General Electric Co.
Morgan Engineering Co.

Converters, Synchronous
* General Electric Co.

Conveying Machinery
Ambursen Co.
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
Fairmont Mining Mach. Co.
* Hunt Co., Inc., C. W.
Jeffrey Mfg. Co.
* Link-Belt Co.
Mathews Gravity Carrier Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Conveying Systems, Pneumatic (Light Material)
Green Fuel Economizer Co.
* Sturtevant Co., B. F.

Conveyors, Belt
* Caldwell & Son Co., H. W.
Fairmont Mining Mach. Co.
Jeffrey Manufacturing Co.
* Link-Belt Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Conveyors, Bucket, Pan or Apron
* Caldwell & Son Co., H. W.
Fairmont Mining Mach. Co.
* Hunt Co., Inc., C. W.
Jeffrey Manufacturing Co.
* Link-Belt Co.
Webster Mfg. Co.

Conveyors, Gravity
Mathews Gravity Carrier Co.

Conveyors, Gravity Roller
Mathews Gravity Carrier Co.

Conveyors, Screw
* Caldwell & Son Co., H. W.
Jeffrey Manufacturing Co.
* Link-Belt Co.
Webster Mfg. Co.

Cooling Ponds, Spray
Schutte & Koerting Co.

Cooling Towers
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Copper, Drawn
* Roebling's Sons Co., John A.

Copper Wire and Cables
(See Wires and Cables, Electrical)

Copper Converting Machinery
* Alliance Machine Co.

Corliss Engines
(See Engines, Corliss)

Counters, Revolution
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.
Bristol Co.
* Veeder Mfg. Co.

Countershafts
Builders Iron Foundry
Dodge Mfg. Co.
* Hill Clutch Co.
Wood's Sons Co., T. B.

Counting Machines, Automatic
* Veeder Mfg. Co.

Couplings, Flexible
* Falls Clutch & Machinery Co.
* Hooven, Owens, Rentschler Co.
* Roots Co., P. H. & F. M.

Couplings, Pipe
* Lunkenheimer Co.
* Pratt & Cady Co., Inc.
Walworth Mfg. Co.

Couplings, Shaft
* Brown Co., A. & F.
* Caldwell & Son Co., H. W.
Cumberland Steel Co.
Dodge Mfg. Co.
* Falls Clutch & Machinery Co.
* Hill Clutch Co.
Holyoke Machine Co.
* Moore & White Co.
Royersford Foundry & Machine Co.
Webster Mfg. Co.
Wood's Sons Co., T. B.

Couplings, Union
(See Unions)

Couplings, Universal Joint
Wood's Sons Co., T. B.

Covering, Boiler
* Keasbey Co., Robt. A.

Covering, Pipe and Tank
* Keasbey Co., Robt. A.

Covering, Steam Pipe
* Keasbey Co., Robt. A.

Cranes, Electric Travelling
* Alliance Machine Co.
Box & Co., Alfred
* Brown Hoisting Machinery Co.
Manning, Maxwell & Moore, Inc.
Morgan Engineering Co.
Shaw Electric Crane Co.
Toledo Bridge & Crane Co.

Cranes, Gantry
* Alliance Machine Co.
* Brown Hoisting Machinery Co.
* Link-Belt Co.
Manning, Maxwell & Moore, Inc.
Morgan Engineering Co.
Orton & Steinbrenner Co.
Shaw Electric Crane Co.
Toledo Bridge & Crane Co.

Cranes, Hand Power
Box & Co., Alfred
* Brown Hoisting Machinery Co.
* Clyde Iron Works
Toledo Bridge & Crane Co.

Cranes, Hydraulic
* Alliance Machine Co.
* Wood & Co., R. D.

Cranes, Jib
* Alliance Machine Co.
Box & Co., Alfred
* Brown Hoisting Machinery Co.
Morgan Engineering Co.
Toledo Bridge & Crane Co.
* Wood & Co., R. D.

Cranes, Locomotive
* Brown Hoisting Machinery Co.
* Link-Belt Co.
Morgan Engineering Co.
Orton & Steinbrenner Co.

Cranes, Pillar
* Brown Hoisting Machinery Co.
Orton & Steinbrenner Co.
Toledo Bridge & Crane Co.

Cranes, Portable
* Brown Hoisting Machinery Co.
* Clyde Iron Works
Lidgerwood Mfg. Co.

Cranes, Wharf
Shaw Electric Crane Co.

Crushers, Jaw
Farrel Foundry & Machine Co.

Crushers, Roll
Eastern Machinery Co.
Jeffrey Manufacturing Co.
Orton & Steinbrenner Co.

Crushing and Grinding Machinery
Farrel Foundry & Machine Co.
* Fulton Iron Works.
Jeffrey Mfg. Co.

Cutters, Bolt
Wells Bros. Co.

Damper Regulators
(See Regulators, Damper)

Derricks and Derrick Fittings
* Brown Hoisting Machinery Co.
* Clyde Iron Works
Lidgerwood Mfg. Co.

Destructors, Refuse
Power Specialty Co.

Die Castings
(See Castings, Die)

Dies, Screw and Thread Cutting
* Jones & Lamson Machine Co.
Wells Bros. Co.

Dies, Self-opening
* Jones & Lamson Machine Co.
Wells Bros. Co.

Digesters, Pulp
* Hooven, Owens, Rentschler Co.

Discs, Steel
* Auburn Ball Bearing Co.

Discs, Valve
(See Valve Discs)

Distillers
Davidson Co., M. T.

Drainage Systems
* Morehead Mfg. Co.

Draft, Mechanical
(See Mechanical Draft Apparatus)

Dredges, Hydraulic
* Morris Machine Works

Drilling Machines, Electric
Fortuna Machine Co.

Drilling Machines, Hand
Fortuna Machine Co.

Drilling Machines, Multiple Spindle
Garvin Machine Co.

Drilling Machines, Pneumatic
* Ingersoll-Rand Co.

Drilling Machines, Portable
Fortuna Machine Co.

Drilling Machines, Rock
* Ingersoll-Rand Co.

Drilling Machines, Vertical
Garvin Machine Co.

Drills, Coal and Slate
Jeffrey Mfg. Co.

Drop Forgings, Hammers, Presses, etc.
(See Forgings, Hammers, Presses, etc., Drop)

Dryers, Direct Heat
* Ruggles-Coles Engineering Co.

Dryers, Rotary
* Devine Co., J. P.
* Ruggles-Coles Engineering Co.

Dryers, Vacuum
* Devine Co., J. P.

Drying Apparatus
* Devine Co., J. P.
Green Fuel Economizer Co.
* Ruggles-Coles Engineering Co.
* Sturtevant Co., B. F.

Economizers, Fuel
Green Fuel Economizer Co.
* Sturtevant Co., B. F.

Ejectors
* Lunkenheimer Co.
Manning, Maxwell & Moore, Inc.
Schutte & Koerting Co.

Ejectors, Ash, Hydraulic
Davidson Co., M. T.

Ejectors, Ash, Pneumatic
* Green Engineering Co.

Electric Generators, Hoists, Trucks, Welding, etc.
(See Generators, Hoists, Trucks, Welding, etc. Electric)

Electrical Instruments
Bristol Co.
Brown Instrument Co.
* General Electric Co.
Wagner Electric Mfg. Co.
Weston Electrical Instrument Co.

Electrical Machinery
* General Electric Co.
Wagner Electric Mfg. Co.

Elevating and Conveying Machinery
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
Fairmont Mining Mach. Co.
* Hill Clutch Co.
* Hunt Co., Inc., C. W.
Jeffrey Manufacturnig Co.
* Link-Belt Co.
Mathews Gravity Carrier Co.
* Robins Conveying Belt Co.
Webster Mfg. Co.

Elevators, Electric
Eastern Machinery Co.

Elevators, Inclined
(See Carriers and Elevators, Freight, Continuous)

Elevators, Passenger and Freight
Eastern Machinery Co.

Emery Wheel Dressers
Builders Iron Foundry

Emery Wheels, Vulcanized Rubber
Manhattan Rubber Mfg. Co.

Engine Stops
* Nordberg Mfg. Co.
Schutte & Koerting Co.

Engines, Automatic
* Ball Engine Co.
Erie City Iron Works
Harrisburg Foundry & Machine Works

Engines, Blowing
* Hooven, Owens, Rentschler Co.
Mesta Machine Co.
Mackintosh, Hemphill & Co.
* Nordberg Mfg. Co.
Weimer Machine Works Co.

Engines, Corliss
* Ball Engine Co.
Brown Engine Co.
* Fulton Iron Works
Harrisburg Foundry & Machine Works
* Hooven, Owens, Rentschler Co.
Mackintosh, Hemphill & Co.
Mesta Machine Co.
* Nordberg Mfg. Co.
Providence Engineering Works
Vilter Mfg. Co.

Engines, Gas and Gasoline
* De La Vergne Machine Co.
* Hooven, Owens, Rentschler Co.
Lanmiert & Mann
Mesta Machine Co.
* National Meter Co.
* Sturtevant Co., B. F.

Engines, High Speed
* Ball Engine Co.
Erie City Iron Works
* Fulton Iron Works
Green Fuel Economizer Co.
Harrisburg Foundry & Machine Works
* Nordberg Mfg. Co.
* Sturtevant Co., B. F.

Engines, Hoisting
(See Hoists, Steam)

Engines, Oil
Brown Engine Co.
* De La Vergne Machine Co.
* Fulton Iron Works
* Nordberg Mfg. Co.

Engines, Poppet Valve, for Superheated Steam
Erie City Iron Works
* Nordberg Mfg. Co.

Engines, Pumping
Davidson Co., M. T.
* Hooven, Owens, Rentschler Co.
* Morris Machine Works
* Wood & Co., R. D.

Engines, Steam
* Ball Engine Co.
Brown Engine Co.
* Clyde Iron Works
Erie City Iron Works
* Fulton Iron Works
Green Fuel Economizer Co.
Harrisburg Foundry & Machine Works
* Hooven, Owens, Rentschler Co.
Lidgerwood Mfg. Co.
Mackintosh, Hemphill & Co.
Mesta Machine Co.
* Morris Machine Works
* Nordberg Mfg. Co.
Providence Engineering Works
* Sturtevant Co., B. F.
* Vilter Mfg. Co.
Weimer Machine Works Co.
* Wheeler Condenser & Engineering Co.

Engines, Uniflow
* Nordberg Mfg. Co.

Evaporators
Davidson Co., M. T.

Excavating Machinery
* Clyde Iron Works
Lidgerwood Mfg. Co
Orton & Steinbrenner Co.

Exhaust Heads
* Sturtevant Co., B. F.

Exhausters, Gas
Green Fuel Economizer Co.
* Roots Co., P. H. & F. M.
Schutte & Koerting Co.
* Sturtevant Co., B. F.

Expansion Joints
(See Joints, Expansion)

Extracting Apparatus
* Devine Co., J. P.

Extractors, Tar
Smith Gas Power Co.

Fans, Electric
* General Electric Co.
Green Fuel Economizer Co.
* Sturtevant Co., B. F.

Fans, Exhaust and Ventilating
Fairmont Mining Mach. Co.
Green Fuel Economizer Co.
Jeffrey Mfg. Co.
* Sturtevant Co., B. F.

Feed Water Circulators, Heaters, Heaters and Purifiers, Regulators, etc.
(See Circulators, Heaters, Heaters and Purifiers, Regulators, etc., Feed Water)

Filters, Air
General Condenser Co.

Filters, Oil
* Richardson Phenix Co.

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Tube Boilers
(See Boilers, Tubular)

Fire Brick, Hydrants, etc.
(See Brick, Hydrants, etc.)

Fittings, Aluminum
* Aluminum Co. of America

Fittings, Ammonia
* De La Vergne Machine Co.
* Vilter Mfg. Co.
Walworth Mfg. Co.

Fittings, Flanged
Builders Iron Foundry
* Lunkenheimer Co.
Nelson Valve Co.
Walworth Mfg. Co.
* Wood & Co., R. D.

Fittings, Hydraulic
Walworth Mfg. Co.
* Wood & Co., R. D.

Fittings, Pipe
* Lunkenheimer Co.
* Richardson-Phenix Co.
Walworth Mfg. Co.

Fittings, Steel
* Lunkenheimer Co.
Nelson Valve Co.
Walworth Mfg. Co.

Flanges
* Lunkenheimer Co.
Walworth Mfg. Co.

Flanging Machines
Morgan Engineering Co.

Floor Stands
Chapman Valve Mfg. Co.
Davis Regulator Co., G. M.
* Ludlow Valve Mfg. Co.
* Lunkenheimer Co.
Nelson Valve Co.
* Pratt & Cady Co., Inc.
Schutte & Koerting Co.
Walworth Mfg. Co.

Forges
Best, W. N.
* Ingersoll-Rand Co.
* Roots Co., P. H. & F. M.
* Sturtevant Co., B. F.

Forging Presses
(See Presses, Forging)

Forgings, Steel
Mesta Machine Co.

Friction Clutches, Hoists, etc.
(See Clutches, Hoists, etc., Friction)

Friction Drives
Rockwood Mfg. Co.

Frictions, Paper and Iron
* Caldwell & Son Co., H. W.
Rockwood Mfg. Co.
Webster Mfg. Co.

Frogs and Switches
Rail Joint Co.

Fuel Economizers
(See Economizers, Fuel)

Furnace Linings
(See Linings, Furnace)

Furnaces, Annealing and Tempering
Best, W. N.

Furnaces, Boiler
American Engineering Co.
Babcock & Wilcox Co.
Best, W. N.
* Green Engineering Co.
* Murphy Iron Works

Furnaces, Melting
Best, W. N.

Furnaces, Oil
* Ingersoll-Rand Co.
Best, W. N.

Furnaces, Smokeless
American Engineering Co.
Babcock & Wilcox Co.
* Green Engineering Co.
* Murphy Iron Works

Gage Boards
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.

Gage Testers
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.

Gages, Ammonia
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.
* Pratt & Cady Co., Inc.

Gages, Differential Pressure
* American Steam Gauge & Valve Mfg. Co.
Bristol Co.
Builders Iron Foundry
Industrial Instrument Co.

Gages, Draft
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.
Bristol Co.
Brown Instrument Co.
Industrial Instrument Co.
Simonds & Co., G. L.
* Tagliabue Mfg. Co., C. J.

Gages, Hydraulic
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.

Gages, Pressure
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.
Bristol Co.
Brown Instrument Co.
* Goulds Manufacturing Co.
Industrial Instrument Co.
Manning, Maxwell & Moore, Inc.

Gages, Thread
Wells Bros. Co.

Gages, Vacuum
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.
Bristol Co.
Brown Instrument Co.
Industrial Instrument Co.
* Tagliabue Mfg. Co., C. J.

Gages, Water
* American Steam Gauge & Valve Mfg. Co.
Ashton Valve Co.
* Jenkins Bros.
* Lunkenheimer Co.
* Pratt & Cady Co., Inc.
Walworth Mfg. Co.

Gages, Water Level
* American Steam Gauge & Valve Mfg. Co.
Bristol Co.
Industrial Instrument Co.

Gas Analysis Instruments
Simonds & Co., G. L.

Gas Burners, Compressors, Engines, Exhausters, Holders, Producers, etc.
(See Burners, Compressors, Engines, Exhausters, Holders, Producers, etc., Gas)

Gas Cleaning Plants
Smith Gas Power Co.
* Wood & Co., R. D.

Gas Plant Machinery
* Wood & Co., R. D.

Gaskets
* Goodrich Co., B. F.
* Jenkins Bros.
* Keasbey Co., Robt. A.
Manhattan Rubber Mfg. Co.
Power Specialty Co.

Gasoline
* Texas Co.

Gates, Blast
* Roots Co., P. H. & F. M.
* Sturtevant Co., B. F.

Gates, Cut-off
Farrel Foundry & Machine Co.
* Hunt Co., Inc., C. W.
* Link-Belt Co.
Webster Mfg. Co.

Gates, Sluice
Chapman Valve Mfg. Co.
* Ludlow Valve Mfg. Co.
* Wood & Co., R. D.

Gear Shapers
* Fellows Gear Shaper Co.

Gears, Cut
* Brown Co., A. & F.
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
Garvin Machine Co.
* Hill Clutch Co.
Holyoke Machine Co.
James Mfg. Co., D. O.
Jeffrey Mfg. Co.
Mackintosh, Hemphill & Co.
Mesta Machine Co.
New Process Gear Corp.
Webster Mfg. Co.

Gears, Fibre
* General Electric Co.
James Mfg. Co., D. O.
New Process Gear Corp.

Gears, Machine Molded
* Brown Co., A. & F.
* Caldwell & Son Co., H. W.
* Hill Clutch Co.
Mesta Machine Co.

Gears, Rawhide
James Mfg. Co., D. O.
New Process Gear Corp.

Gears, Speed Reduction
James Mfg. Co., D. O.

Gears, Worm
* Caldwell & Son Co., H. W.
James Mfg. Co., D. O.
Webster Mfg. Co.

Generating Sets
* General Electric Co.
* Sturtevant Co., B. F.

Generators, Electric
* General Electric Co.
* Sturtevant Co., B. F.
Wagner Electric Mfg. Co.

Glass Machinery, Plate
* Hooven, Owens, Rentschler Co.

Governors, Gas Engine
* Pickering Governor Co.

Governors, Pump
Davis Regulator Co., G. M.
Hughson Steam Specialty Co.
* Richardson-Phenix Co.

Governors, Steam Engine
* Pickering Governor Co.

Governors, Steam Turbine
* Pickering Governor Co.

Governors, Water Wheel
Holyoke Machine Co.

Grates, Shaking
Erie City Iron Works

Greases
Roversford Foundry & Machine Co.
* Texas Co.

Grease Cups
(See Oil and Grease Cups)

Grease Extractors
(See Separators, Oil)

Grinders
* Brown Co., A. & F.

Grinding or Polishing Machines
Builders Iron Foundry
Garvin Machine Co.
Heald Machine Co.
Roversford Foundry & Machine Co.

Grinding Machines, Cutter
Heald Machine Co.
Le Blond Machine Tool Co., R. K.

Grinding Machines, Cylindrical
Heald Machine Co.

Grinding Machines, Drill
Heald Machine Co.

Grinding Machines, Internal
Heald Machine Co.

Grinding Machines, Portable, Pneumatic
* Ingersoll-Rand Co.

Grinding Machines, Surface
Heald Machine Co.

Grinding Machines, Tool
Heald Machine Co.
Le Blond Machine Tool Co., R. K.

Gun and Motor Carriages
Morgan Engineering Co.

Hammers, Drop
* Alliance Machine Co.

Hammers, Pneumatic
* Ingersoll-Rand Co.

Hammers, Steam
* Alliance Machine Co.
Morgan Engineering Co.

Hangers, Shaft
* Brown Co., A. & F.
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.
* Falls Clutch & Machinery Co.
* Hill Clutch Co.
Jeffrey Mfg. Co.
Royersford Foundry & Machine Co.
Webster Mfg. Co.
Wood's Sons Co., T. B.

Head Gates
Holyoke Machine Co.

Heaters, Feed Water (Closed)
Erie City Iron Works
National Pipe Bending Co.
Schutte & Koerting Co.
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Heaters, Metering
Harrison Safety Boiler Works

Heaters and Purifiers, Feed Water (Open)
Erie City Iron Works
Harrison Safety Boiler Works
National Pipe Bending Co.

Heating Boilers
(See Boilers, Heating)

Heating and Ventilating Apparatus
Green Fuel Economizer Co.
* Smith Co., H. B.
* Sturtevant Co., B. F.

Hoisting and Conveying Machinery
Box & Co., Alfred
* Brown Hoisting Machinery Co.
* Clyde Iron Works
* Hunt Co., Inc., C. W.
Jeffrey Mfg. Co.
Lidgerwood Mfg. Co.
* Link-Belt Co.
Orton & Steinbrenner Co.
* Robins Conveying Belt Co.

Hoists, Air
* Ingersoll-Rand Co.
* Nordberg Mfg. Co.

Hoists, Belt
* Clyde Iron Works
Lidgerwood Mfg. Co.

Hoists, Electric
* Alliance Machine Co.
Box & Co., Alfred
* Brown Hoisting Machinery Co.
* Clyde Iron Works
* General Electric Co.
* Hunt Co., Inc., C. W.
Lidgerwood Mfg. Co.
* Link-Belt Co.
* Nordberg Mfg. Co.
Orton & Steinbrenner Co.
* Robins Conveying Belt Co.
Shaw Electric Crane Co.

Hoists, Friction
Eastern Machinery Co.

Hoists, Hand
* Brown Hoisting Machinery Co.
* Clyde Iron Works
* Link-Belt Co.

Hoists, Mine
Lidgerwood Mfg. Co.
* Nordberg Mfg. Co.

Hoists, Skip
* Hunt Co., Inc., C. W.
* Robins Conveying Belt Co.

Hoists, Steam
* Clyde Iron Works
* Hunt Co., Inc., C. W.
Lidgerwood Mfg. Co.
* Morris Machine Works
* Nordberg Mfg. Co.
Orton & Steinbrenner Co.

Holders, Gas
* Wood & Co., R. D.

Hose, Air
* Goodrich Co., B. F.
* Ingersoll-Rand Co.
Manhattan Rubber Mfg. Co.

Hose, Linen
* Goodrich Co., B. F.
Manhattan Rubber Mfg. Co.

Hose, Oil
* Goodrich Co., B. F.
Manhattan Rubber Mfg. Co.

Hose, Rubber
* Goodrich Co., B. F.
Manhattan Rubber Mfg. Co.

Hose, Steam
* Goodrich Co., B. F.
* Ingersoll-Rand Co.
Manhattan Rubber Mfg. Co.

Hose, Suction
* Goodrich Co., B. F.
Manhattan Rubber Mfg. Co.

Hose Attachments (Couplings, Bands, Holders, Clamps, etc.)
* Goodrich Co., B. F.
* Ingersoll-Rand Co.
Manhattan Rubber Mfg. Co.

Hydrants, Fire
Chapman Valve Mfg. Co.
* Ludlow Valve Mfg. Co.
* Pratt & Cady Co., Inc.
* Wood & Co., R. D.

Hydraulic Jacks, Rams, Presses, Turbines, etc.
(See Jacks, Rams, Presses, Turbines, etc., Hydraulic)

Hydraulic Machinery
* Alliance Machine Co.
Holyoke Machine Co.
Mackintosh, Hemphill & Co.
Morgan Engineering Co.
* Wood & Co., R. D.

Hydrokineters
Schutte & Koerting Co.

Hydrometers
* Tagliabue Mfg. Co., C. J.

Hygrometers
Brown Instrument Co.
* Tagliabue Mfg. Co., C. J.

Ice and Refrigeration Machinery
* De La Vergne Machine Co.
* Vilter Mfg. Co.

Ice Tools
* Caldwell & Son Co., H. W.

Impregnating Apparatus
* Devine Co., J. P.

Incandescent Lamps
(See Lamps, Incandescent)

Indicator Posts
Chapman Valve Mfg. Co.
* Ludlow Valve Mfg. Co.
* Pratt & Cady Co., Inc.
* Wood & Co., R. D.

Indicators, Engine
* American Steam Gauge & Valve Mfg. Co.
Manning, Maxwell & Moore, Inc.

Indicators, Sight Flow
* Richardson-Phenix Co.

Indicators, Smoke
Simonds & Co., G. L.

Indicators, Speed
* American Steam Gauge & Valve Mfg. Co.
Brown Instrument Co.
* Veeder Manufacturing Co.
Weston Electrical Instrument Co.

Industrial Railway Equipment
* Hunt Co., Inc., C. W.

Ingot Strippers
* Alliance Machine Co.
Morgan Engineering Co.

Injectors
Manning, Maxwell & Moore, Inc.
* Lunkenheimer Co.
Schutte & Koerting Co.

Insulating Materials (Heat and Cold)
* Keasbey Co., Robt. A.

Jigs and Fixtures
Cowdrey Machine Works, C. H.

Joints, Expansion
* Lunkenheimer Co.
Power Specialty Co.
Walworth Mfg. Co.
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Joints, Flanged Pipe
Walworth Mfg. Co.

Joints, Rail
Rail Joint Co.

Jolt Ramming Machines
(See Rammers, Foundry)

Kilns, Dry
* Sturtevant Co., B. F.

Lamps, Incandescent and Arc
* General Electric Co.

Land-Clearing Machinery
* Clyde Iron Works

Lathe Attachments
Le Blond Machine Tool Co., R. K.

Lathes
Builders Iron Foundry
Garvin Machine Co.
* Jones & Lamson Machine Co.
Le Blond Machine Tool Co., R. K.
Manning, Maxwell & Moore, Inc.
* Warner & Swasey Co.

Lathes, Automatic
* Jones & Lamson Machine Co.

Lathes, Brass
Garvin Machine Co.
* Warner & Swasey Co.

Lathes, Chucking
* Jones & Lamson Machine Co.

Lathes, Speed
Le Blond Machine Tool Co., R. K.

Lathes, Turret
Garvin Machine Co.
* Jones & Lamson Machine Co.
* Warner & Swasey Co.

Lathes, Turret, Vertical
King Machine Tool Co.

Leather Belting, Packing, etc.
(See Belting, Packing, etc., Leather)

Leathers, Automobile
Schieren Co., Chas. A.

Leathers, Pump
Schieren Co., Chas. A.
Williams & Sons, I. B.

Lightning Arresters
* General Electric Co.

Linings, Furnace
Best, W. N.
* Betson Plastic Fire Brick Co.

Liquid Fuel Equipment
Best, W. N.

Loaders, Box Car
Fairmont Mining Mach. Co.

Loaders, Wagon
Jeffrey Mfg. Co.
* Link-Belt Co.

Locomotives, Compressed Air
* Ingersoll-Rand Co.

Locomotives, Electric
* General Electric Co.
* Hunt Co., Inc., C. W.
Jeffrey Mfg. Co.
* Robins Conveying Belt Co.

Logging Machinery
* Clyde Iron Works
Lidgerwood Mfg. Co.

Lubricants
Royersford Foundry & Machine Co.
* Texas Co.

Lubricators, Cylinder
Crescent Mfg. Co.
* Lunkenheimer Co.
* Richardson-Phenix Co.

Lubricators, Force-Feed
* Lunkenheimer Co.
* Pickering Governor Co.
* Richardson-Phenix Co.

Lubricators, Hydrostatic
Crescent Mfg. Co.
* Lunkenheimer Co.

Machinery
(Is classified under the headings descriptive of character thereof)

Machinery Dealers
Garvin Machine Co.
Manning, Maxwell & Moore, Inc.

Machinists and Engineers
* Brown Co., A. & F.
Builders Iron Foundry
* Caldwell & Son Co., H. W.
Cowdrey Machine Works, C. H.
* Hill Clutch Co.
Lammert & Mann
Webster Mfg. Co.
Weimer Machine Works Co.
* Wood & Co., R. D.

Marine Transfers
Lidgerwood Mfg. Co.

Mechanical Draft Apparatus
Green Fuel Economizer Co.
* Sturtevant Co., B. F.

Mechanical Stokers
(See Stokers)

Metals, Bearing
Dodge Mfg. Co.

Metals, Extruded
* Aluminum Co. of America

Metal Work, Plate
Heine Safety Boiler Co.
* Keeler Co., E.
* Wood & Co., R. D.

Meters, Air, Steam and Gas
Builders Iron Foundry
* General Electric Co.

Meters, Electric
Bristol Co.
Brown Instrument Co.
* General Electric Co.

Meters, V-Notch
Harrison Safety Boiler Works
Yarnall-Waring Co.

Meters, Venturi
Builders Iron Foundry
* National Meter Co.

Meters, Water
Builders Iron Foundry
* General Electric Co.
Harrison Safety Boiler Works
* National Meter Co.
Yarnall-Waring Co.

Micrometers
Wells Bros. Co.

Milling Attachments
Garvin Machine Co.
Le Blond Machine Tool Co., R. K.

Milling Machines, Hand
Garvin Machine Co.

Milling Machines, Horizontal
Garvin Machine Co.

Milling Machines, Plain
Garvin Machine Co.
Le Blond Machine Tool Co., R. K.
* Warner & Swasey Co.

Milling Machines, Universal
Garvin Machine Co.
Le Blond Machine Tool Co., R. K.

Milling Machines, Vertical
Garvin Machine Co.

Mills, Blooming and Slabbing
Mackintosh, Hemphill & Co.
Mesta Machine Co.

Mills, Sheet and Plate
Mackintosh, Hemphill & Co.
Mesta Machine Co.

Mills, Structural, Rail and Bar
Mackintosh, Hemphill & Co.
Mesta Machine Co.

Mills, Sugar Cane
Farrel Foundry & Machine Co.
* Fulton Iron Works
Mesta Machine Co.

Monorail Systems
(See Tramrail Systems, Overhead)

Motor-Generators
* General Electric Co.
Wagner Electric Mfg. Co.

Motors, Compressed Air
* Ingersoll-Rand Co.

Motors, Electric
* General Electric Co.
* Sturtevant Co., B. F.
Wagner Electric Mfg. Co.

Nozzles, Blast
Schutte & Koerting Co.

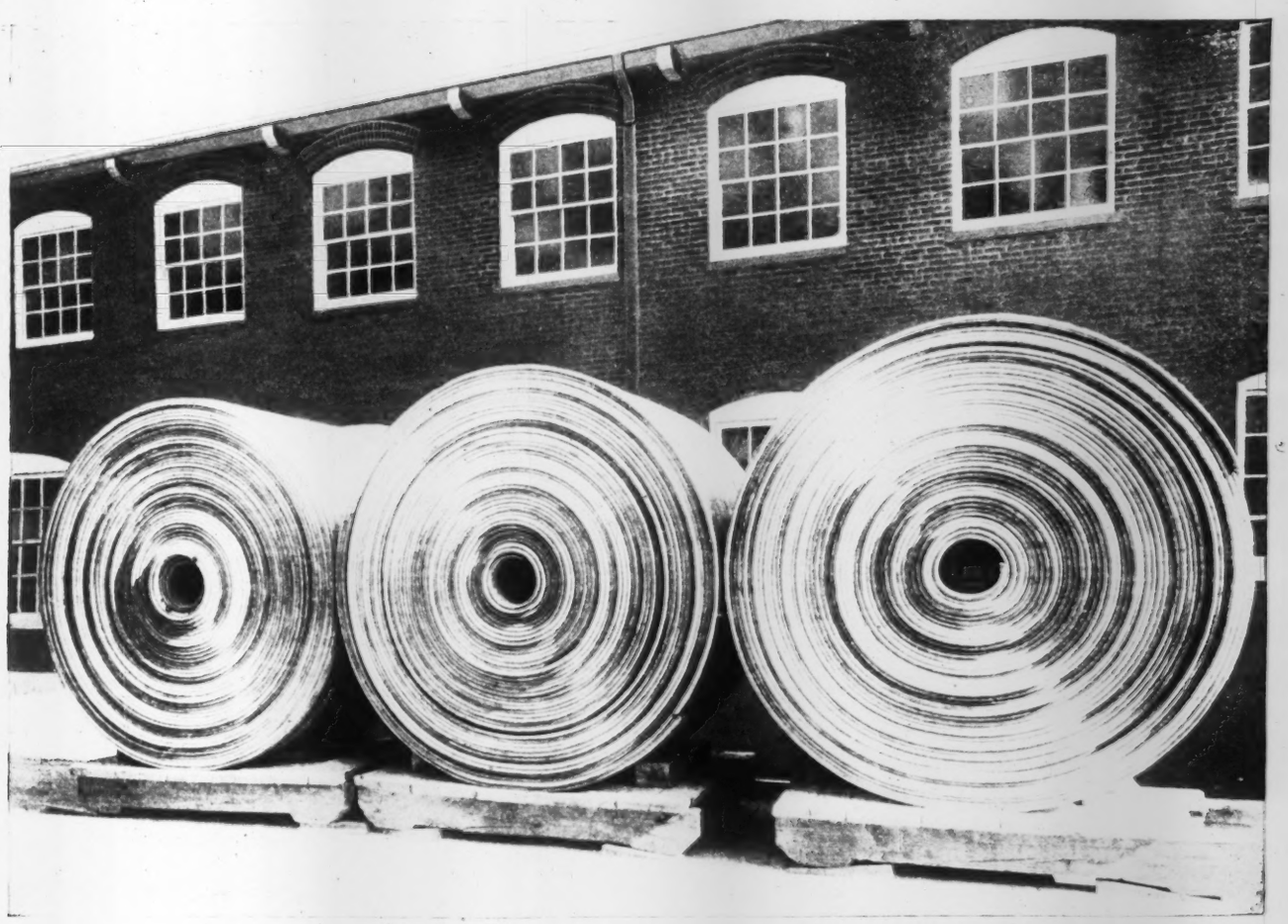
Nozzles, Sand and Air
* Ingersoll-Rand Co.
* Lunkenheimer Co.

Nozzles, Spray
Schutte & Koerting Co.

*Catalogue data of firms marked * appear in the A. S. M. E. Condensed Catalogues of Mechanical Equipment, 1914 Volume.*

Rubber Conveying Belt—Laminated Construction.

The Belt designed by a Rubber Engineer who knows the Science of Conveying from long practical experience in various parts of the world.



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Oilers, Telescopic
* Richardson-Phenix Co.

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* Lunkenheimer Co.
* Richardson-Phenix Co.

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Power Specialty Co.

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* Jenkins Bros.
* Keasbey Co., Robt. A.
Manhattan Rubber Mfg. Co.
Power Specialty Co.

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* Jenkins Bros.
* Keasbey Co., Robt. A.
Manhattan Rubber Mfg. Co.

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* Jenkins Bros.
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Manhattan Rubber Mfg. Co.

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Lidgerwood Mfg. Co.

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Mackintosh, Hemphill & Co.
Mesta Machine Co.

Pinions, Rawhide
New Process Gear Corp.

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Builders Iron Foundry

Pipe, Riveted Steel
* Keeler Co., E.

Pipe, Steel
Walworth Mfg. Co.

Pipe, Wrought Iron
Walworth Mfg. Co.

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National Pipe Bending Co.
Walworth Mfg. Co.

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(See Coils, Covering, Cutters, Fittings, Joints, etc., Pipe)

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(See Clamps, Pipe Joint)

Piston Valves
(See Valves, Piston)

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(See Metal Work, Plate)

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(See Air Lift Pumping Systems)

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Builders Iron Foundry
Royersford Foundry & Machine Co.

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(See Engines, Poppet Valve)

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Eastern Machinery Co.
* Falls Clutch & Machinery Co.
Farrel Foundry & Machine Co.
* Hill Clutch Co.
Holyoke Machine Co.
Jeffrey Mfg. Co.
* Link-Belt Co.
* Moore & White Co.
Royersford Foundry & Machine Co.
Webster Mfg. Co.
Wood's Sons Co., T. B.

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* Falls Clutch & Machinery Co.
Farrel Foundry & Machine Co.
Holyoke Machine Co.
Manning, Maxwell & Moore, Inc.
Mackintosh, Hemphill & Co.
Mesta Machine Co.
Morgan Engineering Co.
* Wood & Co., R. D.

Presses, Foot
Royersford Foundry & Machine Co.

Presses, Forging (Steam-Hydraulic)
Mesta Machine Co.
* Wood & Co., R. D.

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Royersford Foundry & Machine Co.

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(See Regulators, Pressure)

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Smith Gas Power Co.
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Holyoke Machine Co.
Jeffrey Mfg. Co.
Webster Mfg. Co.
Wood's Sons Co., T. B.

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Rockwood Mfg. Co.

Pulleys, Steel
* Caldwell & Son Co., H. W.

Pulleys, Wood
* Caldwell & Son Co., H. W.
Dodge Mfg. Co.

Pulverizers
* Brown Co., A. & F.
Jeffrey Mfg. Co.

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(See Governors, Valves, etc., Pump)

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(See Engines, Pumping)

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* Morris Co., I. P.
* Morris Machine Works
Providence Engineering Works
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.
* Wood & Co., R. D.

Pumps, Air
Davidson Co., M. T.
General Condenser Co.
* Goulds Manufacturing Co.
Mesta Machine Co.
* Roots Co., P. H. & F. M.
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Pumps, Ammonia
Davidson Co., M. T.

Pumps, Boiler Feed
Davidson Co., M. T.
* Goulds Manufacturing Co.
Providence Engineering Works
* Wheeler Mfg. Co., C. H.

Pumps, Centrifugal
* Goulds Manufacturing Co.
* Morris Co., I. P.
* Morris Machine Works
Providence Engineering Works
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.
* Wood & Co., R. D.

Pumps, Condensation, with Automatic Receivers
Davidson Co., M. T.
* Wheeler Mfg. Co., C. H.

Pumps, Deep Well
Davidson Co., M. T.
* Goulds Manufacturing Co.
* Ingersoll-Rand Co.
* Morris Machine Works

Pumps, Dredging
* Morris Machine Works
* Wood & Co., R. D.

Pumps, Dry Vacuum
(See Pumps, Vacuum)

Pumps, Electric
Fairmont Mining Mach. Co.
* Goulds Manufacturing Co.
* Morris Machine Works
* Wood & Co., R. D.

Pumps, Hand
* Goulds Manufacturing Co.

Pumps, Hydraulic Pressure
Davidson Co., M. T.
* Goulds Manufacturing Co.
* Morris Machine Works
* Wood & Co., R. D.

Pumps, Oil
* Goulds Manufacturing Co.
* Lunkenheimer Co.
* Richardson-Phenix Co.
* Roots Co., P. H. & F. M.
* Wood & Co., R. D.

Pumps, Oil, Force-Feed
* Lunkenheimer Co.
* Pickering Governor Co.
* Richardson-Phenix Co.

Pumps, Power
Davidson Co., M. T.
Fairmont Mining Mach. Co.
* Goulds Manufacturing Co.
Holyoke Machine Co.
* Wood & Co., R. D.

Pumps, Rotary
* Goulds Manufacturing Co.
Holyoke Machine Co.
Lammert & Mann
* Roots Co., P. H. & F. M.

Pumps, Self-Measuring
* Richardson-Phenix Co.

Pumps, Steam
Davidson Co., M. T.
* Wheeler Condenser & Engineering Co.
* Wheeler Mfg. Co., C. H.

Pumps, Sump
Fairmont Mining Mach. Co.
* Goulds Manufacturing Co.
* Morris Machine Works
* Wood & Co., R. D.

Pumps, Tank
Davidson Co., M. T.
* Goulds Manufacturing Co.
* Wheeler Mfg. Co., C. H.
* Wood & Co., R. D.

Pumps, Turbine
* General Electric Co.
* Morris Machine Works
* Wood & Co., R. D.

Pumps, Vacuum
Davidson Co., M. T.
* Devine Co., J. P.
General Condenser Co.
* Goulds Manufacturing Co.
Lammert & Mann
Mesta Machine Co.
* Nordberg Mfg. Co.
* Roots Co., P. H. & F. M.
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Morgan Engineering Co.
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Punches, Power
Royersford Foundry & Machine Co.

Punches, Multiple
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* Wood & Co., R. D.

Punches and Dies
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* Alliance Machine Co.
Morgan Engineering Co.
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Harrison Safety Boiler Works
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Ashton Valve Co.
Brown Instrument Co.
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Pyrometers, Radiation
Brown Instrument Co.

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Racks, Cut
James Mfg. Co., D. O.

Radiators, Indirect
* Smith Co., H. B.

Radiators, Steam
* Smith Co., H. B.
Walworth Mfg. Co.

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(See Joints, Rail)

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Andersen Co.
Fairmont Mining Mach. Co.
* Hunt Co., Inc., C. W.
* Robins Conveying Belt Co.

Railways for Industrial Purposes
* Hunt Co., Inc., C. W.
* Link-Belt Co.

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* Ingersoll-Rand Co.

Rams, Hydraulic
* Goulds Manufacturing Co.

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Receivers, Air
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* Ingersoll-Rand Co.
* Nordberg Mfg. Co.
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*Catalogue data of firms marked * appear in the A. S. M. E. Condensed Catalogues of Mechanical Equipment, 1914 Volume.*

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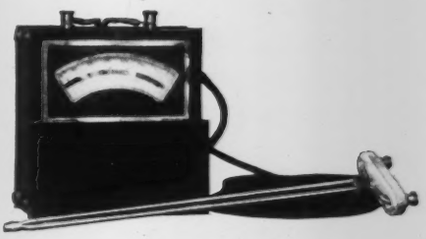

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Hughson Steam Specialty Co.
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(See Governors, Pump)

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(See Bearings, Roller)

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Separators, Oil
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Hughson Steam Specialty Co.
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Harrison Safety Boiler Works
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Morgan Engineering Co.

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Mesta Machine Co.
Morgan Engineering Co.
* Wood & Co., R. D.

Shears, Plate
* Alliance Machine Co.
Farrel Foundry & Machine Co.
Mackintosh, Hemphill & Co.
Mesta Machine Co.
Morgan Engineering Co.
* Wood & Co., R. D.

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* Hill Clutch Co.
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(See Whistles, Steam)

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(See Valves, Slide)

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(See Gates, Sluice)

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(See Indicators, Smoke)

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(See Stacks, Steel)

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Scaife & Sons Co., Wm. B.

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Garvin Machine Co.
Holyoke Machine Co.
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Mesta Machine Co.
Morgan Engineering Co.
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(See Nozzles, Spray)

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* Link-Belt Co.
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Webster Mfg. Co.

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(See Wire Rope Fastenings)

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* Keeler Co., E.

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* Nordberg Manufacturing Co.

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Wagner Electric Mfg. Co.

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(See Engines, Separators, Shovels, Superheaters, Traps, Turbines, etc., Steam)

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Hughson Steam Specialty Co.
* Lunkenheimer Co.
Manning, Maxwell & Moore, Inc.
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Steel, Cold Drawn
* Union Drawn Steel Co.

Steel, Cold Rolled
Cumberland Steel Co.
* Union Drawn Steel Co.

Steel, Nickel
* Union Drawn Steel Co.

Steel, Open Hearth
* Union Drawn Steel Co.

Steel, Vanadium
* Union Drawn Steel Co.

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Babcock & Wilcox Co.
* Green Engineering Co.
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Stokers, Chain Grate
Babcock & Wilcox Co.
Green Engineering Co.

Stokers, Inclined Grate
* Murphy Iron Works

Stokers, Underfeed
American Engineering Co.

Strainers, Water
Davidson Co., M. T.
Schutte & Koerting Co.

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* Wood & Co., R. D.

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Power Specialty Co.

Superheaters, Steam
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(See Converters, Synchronous)

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(See Blocks, Tackle)

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* Aluminum Co. of America

Tanks, Copper
Scaife & Sons Co., Wm. B.

Tanks, Storage
Scaife & Sons Co., Wm. B.

Tanks, Welded
Scaife & Sons Co., Wm. B.

Tapping Machines
Garvin Machine Co.

Taps and Dies
Wells Bros. Co.

Telphers
(See Tramrail Systems, Overhead)

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Fairmont Mining Mach. Co.

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* Brown Instrument Co.
Industrial Instrument Co.

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Tools, Pipe Fitters
Walworth Mfg. Co.

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* Hunt Co., Inc., C. W.

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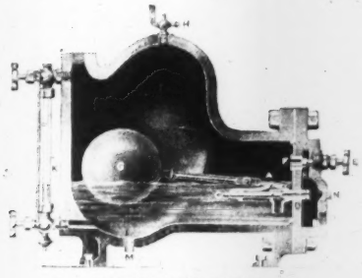

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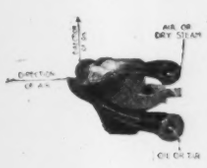

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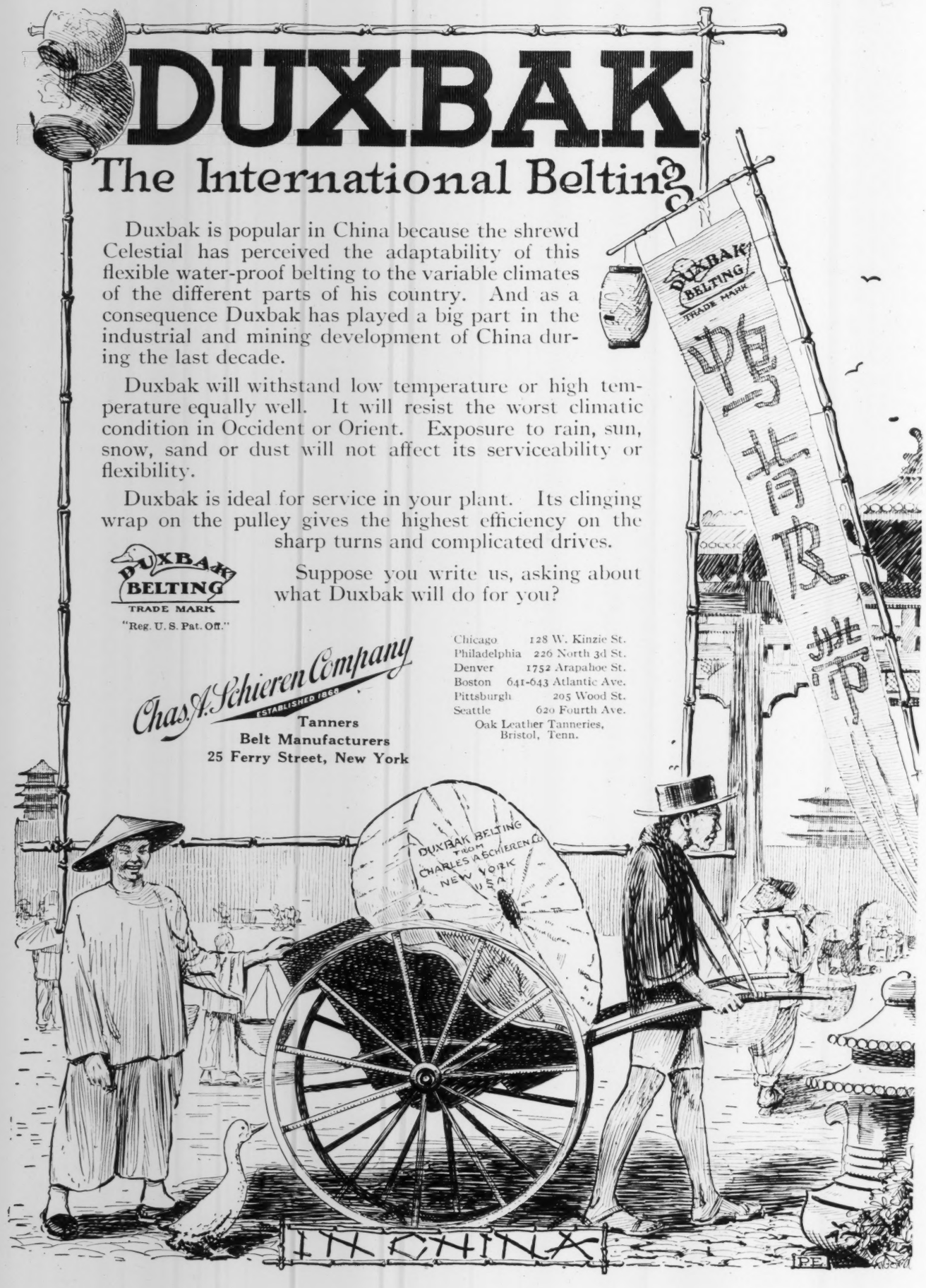

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